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NOTES ON THE PARASITIC FUNGI OF ILLINOIS

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(WITH PLATE 34)

In this much delayed supplement to the four papers that have preceded it ¹ a number of novelties are presented, both in genera and in species, some comparisons are made and keys constructed for special groups of species, and notes on extended distributions and host ranges are given. These are based on material in the Mycological Collection of the Illinois State Natural History Survey, and type and other specimens are designated by their accession numbers in that collection. The collections were made by Mr. G. L. Stout, formerly Field Botanist of the Illinois State Natural History Survey, and by the writer.

The nomenclature of the hosts is that given in Gray's New Manual of Botany, Seventh Edition, except for cultivated plants, for which Bailey's Manual of Cultivated Plants is followed. Type specimens will be found duplicated, as far as our material will permit, in the herbarium of The New York Botanical Garden. Further distribution is not planned, but mycologists are assured that a desire to examine material will receive most cordial consideration.

MICROTHYRIELLA RUBI Petrak.

Though they frequently pass unnoticed, "fly speck" fungi are relatively common on members of the Rosaceae in temperate

¹ See Mycologia 16: 135-142, for the first of the series; *ibid.* 17: 240-249, for "Notes—II"; *ibid.* 19: 110-129, for "Notes—III"; and *ibid.* 21: 180-196, for "Notes—IV."

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regions. In the main they are little understood, since as usually seen they consist only of a thallus and do not furnish either ascigenous or conidial reproductive bodies.

A chance collection on a wild species of *Rubus*, *R. argutus* Link, made near Pana, Christian County, Ill., July 1, 1926 (Acc. No. 22, 447), furnished an ascigerous stage and suggests a possible relationship for the commonly non-sporulating forms found on other members of the rose family.

The "fly speck" on *Rubus*, as exemplified by our material, is tiny—rarely more than $\frac{1}{8}$ mm. in diameter—shining black, and circular in outline to the naked eye. The thyriothechia are arranged in groups without special relation to one another on one side of the stem and are placed without relation to buds, leaf-scars, leaves or thorns, as shown in plate 34, figure 1. Microscopically, however, they are found to be irregular in outline, with decidedly erose margins, 150–375 μ in diameter, and by transmitted light brown and relatively translucent. In structure, they are pseudoparenchymatic and consist of a somewhat arched, shield-like plate of cells which covers the ascogenous region. A true radiate structure appears not to be present, but the plate of mycelium is traversed at irregular intervals, and in various directions, by lines, or rows of cells, possibly hyphae, that are larger and more heavily walled than the bulk of the cells making up the plate. This characteristic is shown in plate 34, figures 2 and 3. These strands form a sort of framework, as if for the support of the roof of the spore-bearing structure, and the interstices between them are completely filled with cells and branches irregularly proliferated from them. Toward the margins of the plates, the rafter strands become less clearly distinguished, merging as shown in plate 34, figure 4 into the cells which form the edge of the plate. The structure here indicates a lack of superficial mycelium extending beyond the fruiting structure, and there is here some indication that the mycelium is "radiate" in structure.

Upon attaining maturity, a central portion of the thyriotheccial plate, somewhat more elevated than the rest, is separated by an irregular crack, as shown in plate 34, figure 2, and reveals, when it falls away, the hymenium below. In this there are a considerable number of nearly spherical to oval, apically thickened asci.

plate 34, figure 5, which contain eight 2-celled spores. The septum in the spore is placed somewhat nearer one end, thus giving to the spore the aspect commonly expected from species of *Mycosphaerella*.

The "fly specks" appear to be derived directly from germinating ascospores, as shown in plate 34, figure 6. This condition was observed but rarely, and then only in connection with very poorly developed thalli. In mature thyriothecia, the spore cannot be discerned.

If the concepts expressed by Theissen and Sydow² are followed, the *Rubus* "fly speck" is referable to the genus *Microthyriella* von Höhnelt and appears in all respects identifiable as *M. Rubi* Petrak, though it appears to have been commonly reported (*vide* Seymour's "Host Index") as *Leptothyrium pomi*.

During our study of this fungus recourse was had to various exsiccati, among them No. 563 in C. F. Baker's "Fungi Malayana." This apparently is part of the type material of *Microthyriella philippinensis* Sydow. But we found it not referable to the genus *Microthyriella*, as it had scolecoform, multiseptate, faintly olivaceous spores and a thyriothecial structure too compact and indistinct to be recognized as that usually seen in the genus. While it is probable that in the collection originally named by Sydow a bonafide *Microthyriella* was seen, it seems necessary to designate the additional material as

***Phragmothyriella Sydowii* sp. nov.**

Thyriothecia strictly epiphyllous, scattered, not in spots, superficial, circular, ostiolate, carbonaceous except a narrow zone at the edge which is olive green, 675-900 μ in diameter, with a compactly interwoven, very fine, hyaline mycelium extending on all sides for an additional 100-300 μ ; ostiole circular, centrally placed, 10-15 μ in diameter, perhaps false; paraphyses none; asci broadly oval to elongate, short stalked, 8-spored, 105 \times 45 to 150 \times 50 μ ; ascospores long, slender, dilute olivaceous, 8- to 11-septate, constricted at the septa, acute at the tips, 100-140 \times 10-16 μ .

Thyriotheciis in pagina supera solim non in maculis sitis sparsis superficialibus rotundatis carbonaceis sed cum zona angusta olivacea-viridi ad margines ostiolatis 675-900 μ diametris mycelio hyalino tenuissimo compaginato

² Ann. Myc. 15: 389-491. 1917.

100–300 μ latitudine cinctis, ostioli rotundatis in centro sitis 10–15 μ diametris, paraphysibus nullis, ascis late ovalibus vel elongatis, 105–150 \times 45–50 μ , sporidiis longis tenuibus dilutis-olivaceis octies ad undecies septatis ad septa angustioribus ad apices acutis 100–140 \times 10–16 μ .

Type: In No. 563, C. F. Baker's "Fungi Malayana," on *Lepisanthes schizolepis*, Los Banos, Province Laguna, Luzon, Philippines, July, 1914, and accompanying slide in the herbarium of the University of Illinois.

PHYLLOSTICTA SMILACIS Ellis & Martin.

A specimen referable to this name was taken on *Smilax rotundifolia* L. July 28, 1926 (Acc. No. 20, 945) near Sparta, Randolph County, Ill. The pycnidia are 60–70 μ in diameter and the spores 10–12 \times 6.5 μ . The pycnidia do not, however, have the definitely formed ostiole characteristic of the species, but appear to open through the breaking away irregularly of a small number of cells near the summit. The context of the pycnidial wall is entirely pseudoparenchymatic, and in this resembles the examples of the species commonly seen. But the specimen is particularly remarkable in that, at the edges of the pycnidia—these are, by the way, spherical when seen in section—where contact is made with the epidermis of the leaf, there occurs an outgrowth of mycelial strands that resemble in form and compactness the so-called "radiate" mycelium characteristic of many of the Hemisphaeriales. The aspect of the pycnidium and its fringe is shown in plate 34, figure 7.

It is, perhaps, unfortunate to have to make report of this peculiarity. A number of names^{3,4} have been given to imperfect forms on species of *Smilax*, and the impression has become prevalent, as a result of Dearness' study, that there is probably only a single polymorphic species involved. In material which we have examined we have not previously seen radiate mycelium and so are inclined to look upon the present material as tending to indicate a lesser relationship among the various forms than might be supposed, though we do not venture at present to segregate our material to the extent that it appears to deserve.

Phyllosticta neuroterigallica sp. nov.

Spots apparent on both leaf surfaces, consisting of a central

³ Dearness, John, in *Mycologia* 9: 351–352. 1917.

⁴ Tehon, L. R., in *Mycologia* 19: 123. 1927.

region 5–10 mm. in diameter which centers in the leaf tumor caused by an insect, *Neuroterus* sp., and definitely bordered outwardly by a black line which is very fine above but diffused to 1 mm. or more of width below and of a peripheral region of indefinite extent that is chestnut brown both above and below, not limited by the veins and with an entire diameter of 2–3 cm.; pycnidia abundant within the central area, erumpent through the upper surface only, spherical, dark brown to completely carbonaceous, 90–180 μ in diameter; ostiole slightly papilliform, usually more fully carbonized than the pycnidial wall, its opening round, 10–15 μ in diameter; spores hyaline, oval, $8.5\text{--}11 \times 6.5\text{--}8 \mu$; mycelium brown, much branched, distantly septate, $3.5\text{--}5 \mu$ in diameter.

Maculis amphigenis 2–3 cm. diametris in tumoribus *Neuroterorum* sitis supra ad marginem linea tenuissima atronitida finitis intus castaneis, pycnidiis abundantibus in centro macularum sphaericis brunneis membranaceis vel carbonaceis 90–180 μ diametris per paginam superam solim erumpentibus, ostiolis paulo papilliformibus carbonaceis rotundatis 10–15 μ diametris, sporidiis hyalinis ovalibus $8.5\text{--}11 \times 6.5\text{--}8 \mu$, mycelio brunneo ramoso remote septato $3.5\text{--}5 \mu$ lato.

On leaves of *Quercus imbricaria* Michx., Dongola, Union County, Ill., Aug. 11, 1927. Acc. No. 22, 830 (type).

In naming this as a new species it has been kept in mind, of course, that the oaks are generally subject to insect attack and that they commonly produce galls and intumescences of various kinds as a result of the attack. A number of imperfect fungi have been discovered in connection with these pathological manifestations. We have made direct comparisons with such fungi as *Botryodiplodia gallae* (Schw.) Petrak & Sydow (for which no less than 14 descriptions or synonyms exist), *Diplodinula gallae* (Ellis & Ev.) Tassi, and *Diplodinula quercina* (Peck) Tassi; but it has been impossible to align our material with any of the samples or descriptions available to us.

Among the species of *Phyllosticta* known in America, those on oaks appear, as indicated by specimens or descriptions, to be separable on the following basis.

Associated with galls or intumescences of insect origin.

Spores $\frac{1}{2}$ as wide as long, $3 \times 10\text{--}12 \mu$.

P. tumoricola.

Spores at least $\frac{1}{2}$ as wide as long.

Spores small, $1\text{--}1.5 \times 2\text{--}3 \mu$.

P. vesicatoria.

Spores large, $6.5\text{--}8 \times 8\text{--}11 \mu$.

P. neuroterigallicola.

Forming characteristic spots and not associated with galls or intumescences.

Spores very large, 18–22 μ long. *P. phomiformis.*

Spores not over 15 μ long.

Spots marginal, often extensive.

Pycnidia up to 150 μ in diameter. *P. ludoviciana.*

Pycnidia 150–200 μ in diameter. *P. agrifolia.*

Spots not marginal, usually definitely limited.

Spores 10 μ or more long. *P. Wislizeni.*

Spores less than 10 μ long.

Pycnidia large, up to 200 μ in diameter. *P. Quercus.*

Pycnidia smaller, up to 150 μ in diameter.

Pycnidia erumpent above only.

Spots white or silvery.

Pycnidia scattered over the spot. *P. Quercus-ilicis.*

Pycnidia collected in center of spot. *P. Quercus-rubrae.*

Spots brown.

Lower surface of spot blistered. *P. virens.*

Lower surface not blistered.

Spores globose, 3–5 μ in diameter. *P. quercea.*

Spores ovoid.

Spore dimensions

2–2.5 \times 5–6 μ .

P. Quercus-prini.

Spore dimensions

2–3 \times 3–5 μ . *P. quercea.*

Pycnidia erumpent to either leaf face.

P. livida.

Phyllosticta dispergens sp. nov.

Spots at first small, 1–2 mm. in diameter, chocolate brown on the upper side, greenish brown on the lower, not limited in size but extending, either alone or by confluence, over much of the leaflet blade, not completely killing the host tissue but producing some discoloration; pycnidia very abundant, scattered, developed in and occupying the mesophyll, opening to either surface, when young yellowish but when mature dark brown without carbonization except in a ring about the ostiole, spherical to applanate, erumpent to the extent of half the height eventually, 80–135 μ in diameter, wall 2–3 cells thick; ostiole only slightly papilliform, the opening round, 6–10 μ wide; spores hyaline, minute, straight, rod-like, 4.5–6 \times 0.7 μ .

Maculis primitis minutis 1-2 mm. diametris in pagina supra brunneolis in pagina infera viridulis extendentibus solim vel confluyente macularum per partem maximam folii, pycnidiis abundantibus sparsis in raedietate folii sitis sed aut superam aut inferam paginam pertudentibus membranaceis brunneis non carbonaceis sphaericis vel deplanatis tandem erumpentibus 80-135 μ diametris, ostiolis paulo papilliformibus, rotundatis 6-10 μ diametris circulo cellarum carbonacearum circumvallatis, conidiis hyalinis minutis rectis bacillaribus $4.5-6 \times 0.7 \mu$.

On leaves of *Rubus flagellaris* Willd., in the vicinity of Belleville, St. Clair County, Ill., Aug. 9, 1927. Acc. No. 829 (type).

Because of the indefinite form and extent of the spot and the apparently non-fatal effect of the attack, this species is exceedingly interesting. It is readily distinguished from *Phyllosticta variabilis* Peck on *Rubus odoratus* L. both by the size of its spores and the kind of spot produced, from *P. Dearnessii* Sacc. on *R. triflorus* Richards by both the pycnidia and spores as well as the nature of the host reaction.

***Phyllosticta Anserinae* sp. nov.**

Folicle, spots diaphyllous, circular, 0.5-1.5 mm. in diameter, cinereous, very distinctly purple margined, not friable; pycnidia 1 to 4 per spot, membranaceous except for a small carbonaceous ring surrounding the ostiole, lying in the pallisade and parenchyma and, in the type at least, opening only epiphyllously, spherical to applanate, 105-165 μ in diameter; ostiole papilliform, carbonized, the opening somewhat irregular, up to 14 μ in diameter; spores issuing in cirrhi, bacilliform, $4.5-6.5 \times 0.9-1.3 \mu$.

Maculis amphigenis rotundatis 0.5-1.5 mm. diametris cinereis non friabilibus cum marginibus purpurascens, pycnidiis membranaceis sphaericis vel applanatis 105-165 μ diametris, in medietate folii sitis paginam superam solim pertudentibus, ostiolis papilliformibus cyclo cellarum carbonacearum circumdati ad 14 μ diametris, sporidiis bacillaribus $4.5-6.5 \times 0.9-1.5 \mu$.

On living leaves of *Potentilla Anserina* L., Witt, Montgomery County, Ill., June 23, 1927. Acc. No. 22, 762 (type).

This species is very close to *P. potentillica* Sacc., from which it differs especially in spore shape, and to *P. fragaricola* Desm. & Rob., from which it differs particularly in having much more slender spores. With regard to spore diameter, it is intermediate between the two old species.

PHYLLOSTICTA MEIBOMIAE Seaver.

Described by Seaver⁵ from material collected by Geo. V. Nash and originally determined as *P. Desmodii* Ellis & Ev., this species

⁵ N. Am. Flora 6: 28. 1919.

has not, so far as we are aware, been recorded elsewhere than in Florida and Alabama, as was originally indicated by Seaver. The assumption might be made that this is strictly a southern form, but its occurrence further north is substantiated by a specimen taken August 11, 1927 near Dongola, Union County, Ill. (Acc. No. 22, 832), which agrees in every particular with Seaver's description. The host, as determined for us by Dr. H. S. Pepon, is *Desmodium Dillenii* Darl. The distinction made by Seaver between *P. macroguttata* Earle and *P. Meibomiae* seems to be well founded and of the order required for separation of species, and this fact adds significance to our Illinois collection especially in that our material was found on the host recorded for Earle's species. As both species, so far as they have been known, were entirely southern, we may suppose that *P. Meibomiae* has extended in its range northward into Illinois along with the coastal swamp forest which has followed the Mississippi, Ohio, and Cache river valleys. The locality in which our collection was taken is, at least, within the range of this extension.

PHYLLOSTICTA ANTIRRHINI Sydow.

In the vicinity of Ashley, Washington County, Ill., there was taken August 26, 1927 (Acc. No. 22, 828) a leaf spot of *Pentstemon hirsutus* (L.) Willd. bearing a *Phyllosticta*. The spots are small—0.5–3 mm. in diameter,—roughly circular in outline, snowy white, friable, and with a tendency to fall away so as to leave rather clean cut circular holes. A narrow, dark purple halo surrounds them. Numerous membranaceous pycnidia dot the white areas of the spots and open chiefly toward the upper surface. On this host, they range from 55–100 μ in diameter. Spores liberated from them are oblong, often definitely allantoid, and measure $3-4.5 \times 1.5-2.3 \mu$.

The spore size corresponds very closely with that given by Guba and Anderson⁶ for *Phyllosticta Antirrhini* when they took spores directly from the host, while the spore shape presents precisely the aspect figured by these authors.

It is exceptionally interesting that a fungus so similar in all particulars should be found native on a host belonging to the same

⁶ Phytopathology 9: 315–325. 1919.

family as does the snapdragon, and one may well believe that the fungus studied by Guba and Anderson, earlier by Stewart,⁷ and later by Smiley⁸ is actually native to this country, even though it be regarded as identical with Sydow's European species. There seems, also, to be no reason for supposing that *Phoma poolensis* Taubenh. differs from this *Phyllosticta*. The writer has not seen authentic material of Sydow's species, but according to the description the European and American forms should give rather definite differences upon closer comparison.

***Phyllosticta scariolicola* sp. nov.**

Spots extending through the leaf but more distinct above, subcircular to distinctly angular and limited by the veinlets, 1-2 mm. in diameter, occasionally confluent, with margins well defined, raised, and purple tinted, the center becoming dark tan, very thin and translucent but not friable until dried; pycnidia scattered, few, generally 4 to 6 per spot, opening to either surface, membranaceous or ultimately becoming opaque by carbonization, subspherical to (more often) very markedly applanate, the flattening mostly basal and giving a horizontal diameter of 70-100 μ and a vertical diameter as small as 20 μ ; ostiole definitely papilliform, the opening subcircular and up to 10 μ in diameter; spores non-septate, oval but very variable, hyaline, with a green tint, $1.5-3 \times 4-6.5 \mu$.

Maculis in foliis amphigenis subcircularibus vel angulatis brunneis cum marginibus purpureis 1-2 mm. diametris, pycnidiis sparsis paucis quatuor ad sex utrique maculae membranaceis in utraque pagina perrumpentibus sphaericis vel deplanatis, 70-100 μ diametris; sporidiis continuis, ovalibus, hyalinis $1.5-3 \times 4-6.5 \mu$.

On living leaves of *Lactuca scariola* L., West Union, Clark County, Ill., June 8, 1927. Acc. No. 22, 503 (type). Also Mt. Vernon, Jefferson County, Ill., June 11, 1927. Acc. No. 22, 523.

So far as I am able to determine, this is the first report of a *Phyllosticta* on *Lactuca scariola* in America. According to Seymour's "Host Index," *L. canadensis* serves as host for *P. decidua* Ellis & Kellerm. and *P. Lactucae* Atk., the former having been reported from Wisconsin by Davis. On *L. spicata* Davis has described *P. Mulgedii*, which is thus far known only from Wisconsin. In the spot it forms and in its other characteristics

⁷ N. Y. (Geneva) Agr. Exp. Sta. Bull. 179. 1900.

⁸ Phytopathology 10: 232-248. 1920.

it is quite obviously different from the species herein named. According to Davis' notes, the form reported by him as *P. decidua* is probably identical with our Illinois material. I am not satisfied, however, to leave the Illinois material in the *decidua* group, because, first, to do so would violate the tenet of specificity of host relationship in a genus known to be, in nature, often very particular and, second, as Seaver has pointed out, the affinities indicated by "*decidua*" forms on various hosts for different ascigerous genera indicate a specific differentiation not clearly recognizable on morphological grounds alone.

***Dendrophoma Zeae* sp. nov.**

Inhabiting extensive areas on blades of arid leaves, not forming spots; pycnidia very abundant, for the most part discrete, arranged in linear series between the veins, becoming erumpent epiphyllously though developed in and occupying the mesophyll, 180–330 μ in diameter, spherical to applanate, often compressed to subspherical between veins, dark brown, membranous, composed of a pseudoparenchyma divided into a dark outer layer, the pycnidium proper, and a hyaline inner layer of variable thickness, seated in a very loose plectenchyma which replaces the host tissue; ostiole papilliform, markedly carbonized, becoming erumpent by rupturing the epidermis, its opening circular, definitely formed, 10–15 μ in diameter; spores hyaline, non-septate, rod-like to oblong or oblong-elliptical, $2-2.5 \times 8-12 \mu$; conidiophores very long and slender, 1–1.5 μ wide, racemously branched, and with the conidia acrogenous. (PLATE 34, FIGS. 8, 9.)

Maculis nullis sed pycnidiis discretis epiphyllis sphaeroideis membranaceis 180–330 μ diametris abundantibus in areis magnis in foliis exaridis, ostioliis papilliformibus carbonaceis rotundatis 10–15 μ diametris, conidiis hyalinis continuis oblongis vel oblongis-ellipticis $2-2.5 \times 8-12 \mu$, basidiis longissimis tenuibus 1–1.5 μ latis ramosis similibus racemo cum conidiis acrogenis.

On arid leaves of *Zea Mays* L., Clay City, Clay County, Ill., Nov. 8, 1926. Communicated by G. L. Stout. Acc. No. 7742 (type).

In the same specimen is found *Macrophoma Zeae* Teh. & Dan., and both forms appear together in sectioned material. Th *Dendrophoma*, in section, appears much like a *Phomopsis*, because of the two distinct layers in the pycnidial wall. The inner, hyaline layer is at times so thick that scarcely more than half the interior of the pycnidium is left for the conidiophores and spores.

Coniothyrium Fagi sp. nov.

Folicole, causing round spots 2-3 mm. in diameter, light brown above with a lighter center, cinereous beneath; pycnidia usually epiphyllous, rarely hypophyllous, carbonaceous at maturity, few, arranged so as to abut on the veins, subspherical to applanate, 100-120 μ in diameter, spore chamber 65-85 μ in diameter; ostiole definite, round, 10-14 μ wide; pycnidia lying in the pallisade and mesophyll; spores non-septate, olivaceous, oval or spherical, mostly $3.5 \times 3 \mu$. Mycelium abundant in the tissue, brown, and forming a loose plectenchyma.

Maculis in foliis irregulariter rotundatis 2-3 mm. diametris brunneolis cum centro pallidior supra cinereis infra, pycnidiis solite paginam superam raro paginam inferiorem penetrantibus carbonaceis sphaericis vel deplanatis 100-120 μ diametris cum loculis sporarum 65-80 μ diametris; ostiolis definitis rotundatis 10-14 μ diametris, sporidiis continuis ovalibus vel sphaericis olivaceis circiter $3.5 \times 3 \mu$; mycelio abundante brunneo.

On leaves of *Fagus grandifolia* Ehrh., Alto Pass, Union County, Ill., June 13, 1927. Acc. No. 22, 555 (type). The type material is scanty, consisting of two leaves, on each of which there are four spots.

Ascochyta plantaginella sp. nov.

Folicole, spots extending through the leaf, subcircular, tan, becoming friable and falling away, 2-5 mm. in diameter, surrounded above but not below by a diffused purple border; pycnidia abundant, scattered, lying in the mesophyll but opening to either surface, yellowish or light brown, membranaceous, and somewhat carbonized about the ostiole, 90-170 μ in diameter, ostiole slightly elevated, 13-17 μ in diameter; spores oblong with rounded ends, chiefly 1-septate, hyaline, occasionally non-septate but never 2-septate, the septum centrally placed and quite distinct, with 2 to 4 guttulae, $8-12 \times 2.5-5 \mu$.

Maculis in foliis amphigenis rotundatis, brunneis, friabilibus 2-5 mm. diametris supra sed non infra annulo purpureo diluto cinctis, pycnidiis abundantibus sparsis in medietate folii sitis per utramque paginam pertusis, luteis aut gilvis membranaceis et paulo carbonaceis circa ostiolum 90-170 μ diametris; ostiolis minimum elevatis et 13-17 μ diametris; sporidiis oblongis utrimque rotundatis hyalinis semel septatis nonnumquam continuis sed nunquam bis septatis, septo in medietate sporidii et distincto, $8-12 \times 2.5-5 \mu$.

On living leaves of *Plantago Rugelii* Dcne., Homer, Champaign County, Ill., June 6, 1929. Acc. No. 22, 014 (type).

Stagonospora Scirpi sp. nov.

Folicole, without spots; pycnidia immersed in the tissue of leaves and sheaths, arranged in rows between the veins, mem-

branaceous, subspherical to applanate, dark olivaceous, 80–205 μ in diameter; ostiole slightly raised and protruding, somewhat carbonized, 12–20 μ in diameter; spores hyaline, oblong to elongate-oval, obtuse at both ends, generally 4-septate but occasionally 3- or 5-septate, 20–28 \times 5–6.5 μ .

Pycnidiis in laminis vaginisque foliorum immersis in seriebus longitudinalibus inter venulas dispositis membranaceis subsphaericis aut applanatis atratis olivaceis 80–205 μ diametris, ostiolis leniter elevatis nonnihil carbonaceis per-tundentibus 12–20 μ diametris, sporidiis hyalinis oblongis aut elongatis-ovalibus utrinque obtusatis ut plurimum quater sed etiam ter et quinquies septatis 20–28 \times 5–6.5 μ .

On leaves and sheaths of *Scirpus atrovirens* Muhl., Duquoin, Perry County, Ill., June 13, 1930. Acc. No. 22, 259 (type).

This is apparently the first report of a *Stagonospora* on a North American *Scirpus*. Forms of the genus previously observed on species of *Scirpus* elsewhere have generally been assigned to two species, *Stagonospora aquatica* Sacc. and *S. scirpicola* Pass. Within the first three subspecies, *junciseda* Sacc., *Karstenii* Sacc., and *lacustris* Sacc., and a variety, *sexseptata* Trail, have been distinguished. All are 3-septate with respect to their spores except the variety *sexseptata*, and the finer distinctions appear to have been made on the basis of spore shape and dimension. It would appear advisable, from the present mycological point of view, to regard Trail's variety as a distinct species, for which the name *Stagonospora sexseptata* (Trail) comb. nov. may be proposed.

The forms on *Scirpus* appear capable of being distinguished on the following basis.

Spores chiefly 3-septate.

Spores 25 μ or more long, not less than 3 μ wide.

Spores not over 30 μ long.

Spore width 5–6 μ .

Spore width 3–4 μ .

Spores up to 40 μ long, 6–8 μ wide.

Spores less than 20 μ long, 2–3 μ wide.

Spores generally more than 3-septate.

Septa usually 4.

Septa usually 6.

S. aquatica.

S. aquatica lacustris.

S. aquatica Karstenii.

S. scirpicola.

S. Scirpi.

S. sexseptata.

Aristastoma gen. nov.

Genus Sphaerioidacearum hyalophragmiarum ab *Stagonospora* circulo setarum circum ostiolum distinctum, pycnidiis sphaericis innatis vel erumpentibus ostiolatis et cum ostiolo circulo setarum coronato; sporidiis oblongis ter vel plus septatis hyalinis.

Aristastoma concentrica sp. nov.

Folicle, causing circular spots 3-8 mm. in diameter, these marked above by alternating concentric zones of red and white tissue, the margin red, and beneath unzoned and brownish red, not friable; pycnidia spherical to applanate, arranged irregularly in the white zones of the spots only, erumpent epiphyllously only, membranaceous except near the ostiole, 180-270 μ in diameter, ostiole circular, 25-35 μ in diameter, crowned by a ring of more or less upright setae, these blackish at the base, elsewhere dark brown, septate, blunt, straight 20-65 μ long by 6.5-10 μ wide; spores oblong, 1- to 4-, mostly 3-septate, 15-35 \times 4.5-6 μ . (PLATE 34, FIGS. 10-14.)

Maculis in foliis rotundatis non friabilibus, 3-8 mm. diametris supra zonis concentricis miniatis et albidis et marginibus miniatis notatis infra sine zonis et rubiginosis, pycnidiis sphaericis in zonis albidis solim dispositis per paginam superam solim erumpentibus membranaceis 180-270 μ diametris, ostiolis rotundatis 25-35 μ diametris circulo setarum erectarum brunnearum septatium obtusatum rectarum 20-65 μ longarum coronatis, sporidiis oblongis semel ad quater sed plurimum ter septatis 15-35 \times 4.5-6 μ .

On leaves of *Vigna sinensis* Endl., Metropolis, Massac County, Ill., Oct. 12, 1927. Acc. No. 5453 (type).

This remarkable disease of cowpea leaves presents several interesting features. In the lesion itself there is the regular alternation of red and white concentric zones as well as limitation of the pycnidia to the white zones, while in the fungus the ring of setae is very distinctive. There is, as shown in plate 34, figure 13, also a very apparent structure in the ostiole, a light colored tissue apparently breaking away from a specialized, annulus-like ring of cells.

Septoria Cunillae sp. nov.

Folicle, spots diaphyllous, irregularly circular, 2-5 mm. in diameter, chestnut brown above, concentrically zoned and with a narrow purple border, grayish brown beneath; pycnidia very few per spot (6-12 in the largest), scattered, situated in the palisade tissue and opening epiphyllously by a very slight protrusion of the papilliform ostiole, carbonaceous at maturity, spherical or irregularly shaped by the crowding of host cells, 35-60 μ in diameter; ostiole round, 10 μ in diameter; spores hyaline, straight, curved, or bent, acute at both ends, the upper end somewhat larger, continuous or remotely septate, 15-40 μ long by about 1.5 μ wide.

Maculis amphigenis irregulariter rotundatis 2-5 mm. diametris brunneis cum zonis pallidis supra viridulis infra; pycnidii paucissimis sparsis sub epidermide sitis per superam paginam pertudentibus carbonaceis sphaericis 35-60 μ diametris; sporidiis hyalinis rectis curvisve utrimque acutatis continuis vel remote septatis, 15-40 μ longis circiter 1.5 μ latis.

On *Cunilla origanoides* (L.) Britt., Alto Pass, Union County, Ill., June 13, 1927. Acc. No. 22, 557 (type).

***Septoria eupatoriicola* sp. nov.**

Folicle, spots extending through the leaf, light brown above, tan below, sunken, not friable, 1-2.5 mm. in diameter, surrounded above by a diffused purple halo of variable extent; pycnidia scattered, developing in the mesophyll and opening either above or below, not strongly beaked and not protruding, membranaceous, brown, up to 115 μ in diameter, ostiole very slightly carbonized, circular, wide, 60-80 μ in diameter; spores hyaline, somewhat obclavate, straight or only slightly curved, blunt at the base, acute at the apex, 3- to 7- but chiefly 5-septate, 30-70 μ long, about 1.5 μ wide.

Maculis in foliis amphigenis brunneis supra brunneolis infra non friabilibus 1-2.5 mm. diametris in pagina supera cum circulo purpureo cinctis, pycnidii sparsis in medietate folii sitis sed aut supra aut infra paulo pertudentibus membranaceis brunneis usque 115 μ diametris, ostiolis latis 60-80 μ diametris, sporidiis hyalinis nonnihil clavatis rectis aut solim leniter curvis obtusis base acutatis apice ter ad septiens sed ut plurimum quinquies septatis 30-60 μ longis circiter 1.5 μ latis.

On leaves of *Eupatorium perfoliatum* L., Duquoin, Perry County, Illinois, June 13, 1930. Acc. No. 22, 260 (type).

In North America *Septoria Eupatorii* Rob. & Desm., has been reported to occur on *Eupatorium serotinum* Michx. and *E. urticifolium* Reich. Its spores are reported to be between 25 and 35 μ long. Sydow has described *Septoria albomaculans* on *E. nubi-genum* Benth. and *E. pomaderrifolium* Benth. from Guatemala, which is said to form snow white spots, to have pycnidia between 120 and 170 μ in diameter, and to produce spores 35-52 μ long. The variability in spore length, pycnidial size and spot characters appears to distinguish our Illinois material quite strongly.

LEPTOTHYRIUM POMI (Mont. & Fries) Sacc.

A specimen on the fruit of *Prunus americana* Marsh., taken near Beechville, Calhoun County, Ill., Sept. 16, 1926 (Acc. No. 7, 736) appears to be of interest. It is identical with our

many collections of "fly speck" on apple, even to the extent of being sterile. This report adds another host to the American list. It is noteworthy that previously the "fly-speck" fungus was known to occur only on *Prunus Persica* (L.) Stokes, *P. serotina* Ehrh., and on "prune." On the first it was reported as *L. pomi*, on the second as *L. cinctum* Cooke.

Confertopeltis gen. nov.

Genus Leptostromatacearum hyalosporarum cum pycnidiis dimidiatis sed bene rotundatis ostiolatis nonnumquam solitariis sed saepissime in stromatibus exilibus confertibus, in epidermide sitis sed erumpentibus, sporidiis bacillariis, et mycelio extimo filiforme proximo radiatim compaginato.

Confertopeltis Asparagi sp. nov.

Stromata variable in size, $300 \times 250 \mu$ when with one pycnidium to $1200 \times 425 \mu$ when with many; pycnidia hemispherical, ostiolate, membranaceous, $150-225 \mu$ in diameter, closely set in the irregularly shaped stroma, composed chiefly of aliform mycelium; ostiole circular, definite, $10-15 \mu$ in diameter, at maturity surrounded by a narrow zone of carbonized cells; spores hyaline, non-septate, rod-like, straight or slightly curved, minute, $2.5-3 \times 1-1.5 \mu$; conidiophores minute, simple. (PLATE 34, FIGS. 15-18.)

Stromates variabiles $300-1200 \times 250-425 \mu$ diametris cum pycnidiis rotundatis ostiolatis membranaceis $150-225 \mu$ diametris in stromatibus contiguis locatis, ostiolis rotundatis $10-15 \mu$ diametris carbonaceis, sporidiis hyalinis continuis bacillaribus rectis vel leniter curvatis $2.5-3 \times 1-1.5 \mu$, basidiis minutis simplicibus.

On arid stems of *Asparagus officinalis* L., Villa Ridge, Pulaski County, Ill., Nov. 10, 1927. Communicated by G. L. Stout. Acc. No. 7295 (type).

This fungus fruits in elongated oval spots on the stems and branches of its host and unless examined closely may be taken for the lesions and telial sori of *Puccinia Asparagi* DC. The pycnidia are developed beneath stomata, through which the ostioles at first open, but eventually the entire stroma becomes more or less erumpent. The spots are definite, rather large and quite characteristic, having in the center a cinereous area which is surrounded first by a zone brown tinted and then by a narrow zone of dark brown. Though not radiate in structure, both the pycnidial cover and the uppermost layer of the stroma are composed of cells which have a distinct aliform aspect. While this

characteristic is very distinct throughout the stroma, the extensive mycelium which occupies the superficial host cells quickly varies to the conventional cylindric form, with clusters of aliform cells at infrequent intervals.

Cribropeltis gen. nov.

Genus *Leptostromatacearum* hyalosporarum cum mycelio superficiali extento clathrato interstitia cuius cum ramis brevibus cerebriformibus opplentur, pycnidiis dimidiatis nigrifactis discretis irregulariter fissuratis distinctis a mycelio suo nigrore et praeterea densa compositione suarum cellarum, basidiis simplicibus, et sporidiis hyalinis continuis ovalibus vel oblongis.

Etymology: *cribrum*, a sieve, and *pelta*, a shield.

Cribropeltis citrullina sp. nov.

Mycelium brown, straight, 3–4 μ in diameter, septate at intervals of 5–15 μ , much branched, the main strands forming with its large branches an open lattice the interstices of which, on and near the pycnothyrium, are filled with short, cerebriform, determinate branches; pycnidia without an ostiole, black but not carbonized, 300–600 μ in diameter, irregularly circular and not clearly distinguishable at the margin from the mycelial subicle, opening by long, narrow, irregular fissures; conidiophores simple, hyaline, clavate, 5–6 \times 2–3 μ , arising from a thin, hyaline basal layer beneath the scutellum; spores non-septate, hyaline, oblong with rounded ends, straight or slightly curved, 10–15 \times 4–5 μ . (PLATE 34, FIGS. 19–21.)

Mycelio bruneo recto 3–4 μ diametro intervallis 5–15 μ septato ramoso et clathrato interstitia cuius in pycnidiis et prope ea cum ramis brevibus cerebriformibus complentur sed exterius solum partim vel haud opplentur, pycnidiis nigrifactis sed non carbonaceis 300–600 μ diametris depressis et non a mycelio clare distinctis, basidiis simplicibus hyalinis erectis clavatis 5–6 μ longis 2–3 μ latis ex strato hyalino basilari sub pelta oriundis, sporidiis continuis hyalinis oblongis rectis vel leniter curvis, 10–15 \times 4–5 μ .

On the fruit of *Citrullus vulgaris* Schrad., Spring Bay, Woodford County, Ill., Sept. 30, 1927. Acc. No. 22, 882 (type).

This fungus forms "fly specks" on the fruit of the watermelon but appears to differ from most of the "fly speck" fungi in having an extensive superficial mycelium, which covers, at times, areas several centimeters wide. The pycnothyria are usually abundantly developed and may come to maturity and disintegrate before the vegetative mycelium disappears. Its most remarkable character appears to be the latticed mycelium of a regular cylindrical form from which arise, especially on and near the

pycnothyria, short aliform branches in such numbers as to entirely fill the interstices.

Discosia Potentillae sp. nov.

Spots cinereous to white with a red border, up to 5 mm. in diameter, pycnidia epiphyllous and hypophyllous, scattered, abundant, circular, sometimes confluent or contiguous, entirely superficial, carbonaceous except at the margin and there evidently radiate in structure, 120–250 μ in diameter, ostiole rounded, more completely carbonized on the slightly raised rim, 15–30 μ in diameter; spores hyaline, curved, blunt at both ends, 3- and 4-septate, $10-15 \times 2.5-3.5 \mu$, furnished at each end with a fine bristle often 7.5 μ long which arises from the inner curve of the spore.

Maculis cinereis aut albescentibus cum marginibus rubris usque 5 mm. diametris, pycnidiis aut in pagina supera aut infera sparsis abundantibus rotundatis nonnumquam contiguis vel confluentibus superficialibus carbonaceis sed in marginibus translucidis et ibi radiantibus 120–250 μ diametris, ostioliis rotundatis carbonaceis leniter elevatis 15–30 μ diametris, sporidiis hyalinis curvis utrumque obtusis ter et quater septatis, $10-15 \times 2.5-3.5 \mu$ cum arista utrumque 7.5 μ longa.

On leaves of *Potentilla canadensis* L., at Marlow, Jefferson County, Ill., Sept. 7, 1926. Acc. No. 22, 390 (type).

Lophodiscella gen. nov.

Genus Excipulacearum hyalosporarum cum pycnidiis hystericiformibus sub cuticula locatis ovalibus discretis membranaceis fesso longitrorsum patefacientibus, sporidiis magnis continuis non catenulatis, et mycelio paulo radiatim formato.

Lophodiscella Asparagi sp. nov.

Caulicolous, in indefinite, straw-colored, extensive spots; exciples subcuticular, oval, membranous, rimose, 130×100 to $300 \times 165 \mu$; spores hyaline, oblong, straight or curved, large, non-septate, 11×4.5 to $20 \times 6 \mu$; conidiophores simple, minute. (PLATE 34, FIGS. 22–27).

Caulogena maculas magnas indeterminatas stramineas incolente, cum pycnidiis excipuliformibus sub cuticula locatis ovalibus membranaceis rimosis $130-300 \mu$ longis $100-165 \mu$ latis, sporidiis hyalinis oblongis rectis curvisve magnis continuis $4.5-6 \times 11-20 \mu$, basidiis simplicibus minutis.

On arid stems of *Asparagus officinalis* L., Villa Ridge, Pulaski County, Ill., Nov. 10, 1927. Acc. No. 7576 (type). Anna, Union County, Ill., Nov. 10, 1927, Acc. No. 7597; Alto Pass, Union County, Ill., Nov. 26, 1926, Acc. Nos. 7603 and 7740.

This genus appears to differ from *Lophodermopsis* Speg. chiefly in having non-catenulate spores and from *Psilospora* Rabenh. in being more nearly like *Lophodermium* than other hysteriaceous forms in its appearance. The mycelium adjacent to the exciples lies between the epidermal cells and the cuticle and forms a loose pseudoradiate plate; but a radiate structure cannot be demonstrated for the mycelium constituting the pycnidial cover. The thick basal plectenchyma appears to give rise, directly, to the conidiophores.

***Colletotrichum aeciicolum* sp. nov.**

Acervuli irregularly circular, sessile, 120–165 μ in diameter; setae marginal only, curved, multiseptate, blunt at the apex, orange-yellow, 200–700 but mostly 500–550 μ long by 3.5–4 μ wide; conidiophores densely crowded, orange-yellow in mass, clavate, 4–6.5 μ long by 2–2.5 μ wide; spores rod-like, hyaline, straight or slightly curved, usually biguttulate, the guttulae polar, but often eguttulate or with 4 evenly spaced guttulae, 7–12, mostly 8–10, by 2–3 μ .

Acervulis irregulariter rotundatis sessilibus 120–165 μ diametris setis curvatis multiseptatis aurentiacis apicibus obtusatis 200–700 μ longis, circumclusis basidiis densis in massa aurentiacis clavatis 4–6.5 \times 2–2.5 μ , sporidiis bacilliformibus hyalinis rectis aut leniter curvis ut plurimum cum duabus polaribus guttulis, 7–12 \times 2–3 μ .

On the unruptured peridia of aecidia of *Puccinia Asterum* Kern in leaves of *Solidago canadensis* L., Beechville, Calhoun County, Illinois, Sept. 16, 1926. Acc. No. 22, 416 (type).

***Colletotrichum Smilacis* sp. nov.**

Folicle, infections at first apical or marginal but soon extending downward along the veins and laterally through the leaf tissue for large distances and eventually blighting more than half of the leaf, diseased tissue at first brown, later cinereous with brown margins; acervuli very abundant in the lesions, narrowly oval to circular in outline, 45–100 μ in diameter, epiphyllous only, developed beneath the cuticle and consisting of a basal mass of dark brown hyphal cells resembling a sclerotium, a layer of hyaline mycelium, conidiophores, spores and setae. Conidiophores hyaline, 6–10 \times 3.5 μ ; spores produced apically, hyaline, curved, non-septate, acute at both ends, 17–22 \times 3.5–4.5 μ ; setae dark brown, straight or variously bent, arising from a bulbous basal cell, continuous or septate, the septa always faint, dilutely colored at the acute tip, 45–125 μ or more long, 4–6.5 μ

wide near the base, chiefly marginal but some protruding through the interior of the acervulus and these much longer larger and darker than those on the margin.

Acervulis in maculis maximis cinerescens abundantissimis anguste ovalibus aut circularibus $45-100\ \mu$ diametris solim epiphyllis sub cuticula locatis ex strato atrato sclerotiforme basillare ex strato hyalino ex strato conidifero et ex setis compositis, setis atratis brunneis rectis vel varie curvis continuis aut septatis apice acutis base in cella magna rotundata sistantibus ut plurimum in marginibus sed ullis in centris acervulorum et hae semper maiores longiores et atratiores; basidiis hyalinis $6-10 \times 3.5\ \mu$; sporidiis acrogenis hyalinis curvis continuis utrinque acutis $17-22 \times 3.5-4.5\ \mu$.

On living leaves of *Smilax hispida* Muhl., Olney, Richland County, Ill., Sept. 21, 1932. Acc. No. 22, 849 (type).

Colletotrichum Dioscoreae sp. nov.

Acervuli abundant in the diseased areas, discrete, contiguous or confluent, round to oval, $50-120\ \mu$ in diameter; setae numerous, marginal except through the confluence of acervuli, black, acute, septate, with a bulbous base, up to $145\ \mu$ long but chiefly $60-80\ \mu$ long; conidiophores minute and hyaline; spores hyaline, non-septate, straight or curved, very variable in size but chiefly $17-18 \times 6\ \mu$.

Acervulis in maculis emortuis abundantibus discretis contiguis vel confluentibus rotundatis vel ovalibus $50-120\ \mu$ diametris, setis numerosis nigris septatis acutis base bullatis $60-145\ \mu$ longis, basidiis minutis hyalinis, sporidiis hyalinis continuis rectis vel curvis variabilissimis sed ut plurimum $17-18 \times 6\ \mu$.

On *Dioscorea villosa* L., Marlow, Jefferson County, Ill., Sept. 7, 1926. Acc. No. 22, 420 (type).

In the type material, the fungus resides in spots on the leaves. These spots are extensive, ranging from small irregular circles of a centimeter in diameter to one-half or more of the leaf. The acervuli occur on both surfaces but are several times as abundant on the upper surface. The spots are at first dark brown and marked concentrically with darker bands but eventually become cinereous and fragile.

Marssonina salicina sp. nov.

Folicle, spots extending through the leaves, brown, circular, $0.5-2\ \text{mm.}$ in diameter, the larger spots with a narrow, darker brown border; acervuli minute, scattered, circular in outline, strictly hypophyllous, $50-80\ \mu$ in diameter; spores hyaline, septate above the middle, curved, blunt at both ends, $20-35 \times 3-4\ \mu$.

Maculis in foliis amphigenis brunneis rotundatis 0.5–2 mm. diametris majores quarum cum marginibus angustis et aterioribus, acervulis minutis sparsis rotundatis in pagina infera solim sitis 50–80 μ diametris, sporidiis hyalinis supra medietatem septatis curvis et utrimque obtusis 20–35 \times 3–4 μ .

On leaves of *Salix nigra* Marsh., Lincoln, Logan County, Ill., June 18, 1930. Acc. No. 22, 258 (type).

A rather large number of species of *Marssonina* (*Marssonina*) have been described on various species of *Salix*. Those connected with discomycetous perfect forms have received the attention of Nannfeldt,⁹ who has concluded that 10 of the named species are retainable as distinct. Four of these, as indicated by the same author,¹⁰ do not have any demonstrated ascigerous connections. The segregation of species of *Marssonina* into narrowly limited species appears to be upheld, according to Nannfeldt, on the basis that these species show definite relation to ascigerous genera and are, as Klebahn found for the *Populus*-inhabiting forms, of very narrow host range. This, however, is somewhat opposed to the view of Davis,¹¹ who considers that forms found in Wisconsin on *Salix longifolia*, *Salix discolor*, *Salix cordata*, *S. syrticola*, and *S. petiolaris* are all referable to *M. Kriegeriana*.

So far as can be determined from samples and descriptions at hand, the *Salix* species of *Marssonina* appear to be distinguishable with reasonable sharpness in the manner indicated in the following analysis.

Spots black above.	<i>M. nigricans.</i>
Spots brown to cinereous above and below.	
Spores consisting of nearly equal cells.	
Spore dimensions 12–20 \times 5–6 μ .	<i>M. apicalis.</i>
Spore dimensions 10–15 \times 2.5–5 μ .	<i>M. rubiginosa.</i>
Spores consisting of distinctly unequal cells.	
Distal cell larger.	
Spore width more than 5 μ .	
Spores 22–29 \times 5–8 μ .	<i>M. Lindii.</i>
Spores 18–22 \times 6–9 μ .	<i>M. dispersa.</i>
Spores 16–25 \times 5–7 μ .	<i>M. salicigena.</i>
Spores 15–17 \times 5–8 μ .	<i>M. salicicola.</i>
Spore width less than 5 μ .	<i>M. Salicis.</i>

⁹ Svensk. Bot. Tidsk. 25: 1–31. 1931.

¹⁰ Nova Acta Reg. Soc. Sci. Upsaliensis, IV, 8: 171. 1932.

¹¹ Trans. Wisc. Acad. Sci. 20: 399–411. 1922.

Proximal cell larger.

Spore dimensions $20-35 \times 3-4 \mu$.

Spore dimensions $13-17 \times 3-6 \mu$.

M. salicina.

M. Kriegeriana.

BOTANICAL SECTION

ILLINOIS STATE NATURAL HISTORY SURVEY

URBANA, ILLINOIS.

EXPLANATION OF PLATE 34

Figs. 1-6, *Microthyriella Rubi*. 1, habit sketch; 2-3, surface views of two thyriothecia, showing general structure and method of opening; 4, portion of edge of thyriothecium; 5, an ascus; 6, germinated ascospore surrounded by cells developed from it; fig. 7, *Phyllosticta Smilacis*. Surface view of a pycnidium showing the irregular ostiole and the fringe of subcuticular aliform mycelium; figs. 8-9, *Dendrophoma Zeae*. 8, pycnidium in section; 9, part of a conidiophore; figs. 10-14, *Aristastoma concentrica*. 10, Cowpea leaflet with spots; 11, spot enlarged, showing zonation and pycnidia in the white zones; 12, side view of pycnidium; 13, view from above, showing unopened ostiole, annulus-like cells, and setae; 14, spores; figs. 15-18, *Confertopeltis Asparagi*. 15, habit sketch; 16, pycnidia in a stroma; 17, aliform cells from top of pycnidium; 18, aliform cells in extra-stromatic mycelium; figs. 19-21, *Cribropeltis citrullina*. 19, pycnothyria enlarged showing the extensive, connecting, superficial mycelium; 20, mycelium from 3 regions: 1, on the pycnothyrium; 2, just beyond its edge; 3, at some distance from it. Note how the interstices of the lattice are filled with aliform cells; 21, spores; figs. 22-27, *Lophodiscella Asparagi*. 22, habit sketch; 23, portion of spot showing distribution of excipula; 24, excipulum enlarged; 25, section of excipulum, showing subcuticular position; 26, subcuticular, extraexcipular mycelium showing rudimentary aliform structure; 27, spores.

A NEW FUNGUS PARASITIC ON NEMATODES

C. D. SHERBAKOFF

(WITH PLATE 35)

In the summer of 1931 the writer decided to make a final examination of certain fungi that had developed in a moist chamber in which a batch of strawberry plants had been kept for about three weeks. In the material, his attention was attracted by a fungus with conidia-like bodies having the form of complete, hyaline rings (PLATE 35, FIGS. I, G, N). The thickness of the hypha in the rings was considerably greater than that of the simple, septate branches on which they were produced. The content of the rings was also more dense than that of the hyphae even at the early stages of their growth; later on the branches were observed to be practically void of protoplasm. In some mounts rings both attached to the mycelium and detached were observed in considerable numbers. The detached rings were without any remnants of the hyphae (PLATE 35, FIG. N). Thus they were plainly differentiated from the mycelium and appeared to answer our usual conception of conidia; they are here considered as such. In most cases the septation was indistinct or absent in the rings (PLATE 35, FIG. N); however, infrequently the septation was quite clearly observed (PLATE 35, FIG. I).

On further examination of the fungus it was found to produce other differentiated bodies, from globular to oval in shape (PLATE 35, FIGS. E AND H), on branches similar to the conidiophores terminating with the rings. These resemble young terminal chlamydospores so common in some species of *Fusarium*. Besides these two no other differentiated bodies were observed; and from the beginning it was suspected that the globular bodies were the first stage in the development of the ring-shaped conidia, even though it was not easy to visualize the process of development from the first to the second stage. However, in the material observed this year it was found that the globular bodies at a certain time send out a somewhat pointed tube which, as it

grows, describes a complete circle, with the lower part of the round bodies as the union point thus forming the ring (PLATE 35, FIGS. A, B, C AND D). During this process of formation, the globular body shrinks noticeably in its diameter though even in the completed rings its position is usually marked by a broader part in them. The intermediate stages between the globular and the ring-shaped forms were seldom observed, because apparently the process of development is rapid.

In all of the material examined, various living nematodes were working their way through the maze-like growth of this and various other fungi—mostly *Rhizoctonia* and various species of *Mucor* and *Fusarium*. Shortly after the ring-spored fungus was first found some nematodes were observed with from one to several of the rings over the anterior ends of their bodies (PLATE 35, FIGS. J, K AND L³). Some of the rings were so tightly set on the nematode bodies that there was apparently no chance for the nematodes to slip out of them. It was clear that the more they wiggled the tighter were the rings pushed on. Some of the rings, with the nematodes caught in them, were still attached to the mycelium, and the nematodes were thus firmly held in the place. The writer observed many instances of nematodes entering into the rings, and it was evident that with the forward movement of the nematodes the rings were pushed farther and farther over their tapering bodies until they could be pushed no more. Nematodes were observed to escape in only a few cases.

The observations at once suggested the idea that the fungus was a parasite of the nematodes and that the ring-shaped conidia were a special adaptation of the fungus to the host. In the ring the fungus had a device well suited for the purpose of catching and holding the nematode so as to enable the fungus to grow into and consume it. On several occasions the fungus growth appeared as a cleverly set up network of loop-shaped nematode traps. This device, for its purpose, seems to be at least as good as the loop of the man-made lasso. The present instance of the biological adaptation seems to the writer to be quite an interesting illustration of a mutational rather than gradual development of the species. At least it is hard to see any benefit to the fungus

in anything less than a complete ring, for the purpose of catching nematodes. The idea of parasitism was fully justified later by an observation of a number of dead nematodes, with from one to several of the rings still visible over their bodies and completely filled with the mycelium (PLATE 35, FIGS. B, AND L¹ AND L²). In still later stages only the fungus could be seen, the nematode's body evidently having completely disintegrated. After the development of the fungus in the nematodes it grows out usually by a single straight tube from one or both ends of the nematode. The mycelium that develops outside of the nematode produces at first the globular bodies (PLATE 35, FIGS. E AND H) which sooner or later develop into the rings, in the manner described above. No actual experiments were performed to prove a parasitic relationship.

Although the rings on the nematodes were observed for as much as three consecutive hours, no germination was observed. Germination outside of the nematodes was observed in only one case. In that instance (PLATE 35, FIG. I) the ring produced a short hypha, which terminated in a globular body. Lack of germination was probably due to the unfavorable environment, between the glass slide and cover slip, in water. A few attempts to grow the fungus from the ring-shaped conidia, by a dilution, in potato tuber decoction, dextrose agar, were entirely unsuccessful. A few plantings of ring-bearing nematodes upon the surface of agar have been up to this time also unsuccessful.

The fungus was observed to attack nematodes of the genera *Aphelenchus*, *Cephalobus*, *Dorylaimus*, and *Rhabditis*, as determined by Dr. P. H. Hornburg, and apparently also larvae of some minute flies.

The writer has never before observed a fungus similar to this and does not recall any reference in the literature to any of a similar kind. During the first days of the writer's study of the fungus, because of its unusual appearance and rather striking adaptation to trapping nematodes, it was shown to several members of this Department, Dr. Hornburg included. The latter, looking over the chapter on nematodes in Sorauer's text book on plant diseases (volume 4, 1925) found there, on pages 5 and 6, a brief reference to Zopf's paper on a fungus parasitic on

nematodes which had some peculiar "loops" (Ösen) with which to catch them. Examination of the original paper by Zopf¹ showed that his fungus, *Arthrobotrys oligospora*, was clearly different. The loops, in *A. oligospora*, are those of a three dimensional network (PLATE 35, FIG. M) produced by a peculiar bending over of the hyphal tips toward the same hypha or other hyphae and fusing with them; from about the middle of the bow-shaped portion of the loop thus formed grows out another branch which duplicates the process just described; this is repeated over and over again which gives rise to a complicated network of loops. The hyphae forming the loops are identical with the rest of the mycelium. Later on in the studies, the author was fortunate to find also *A. oligospora*, which was observed growing in association with and separately from the ring fungus. In the cases observed, Zopf's fungus readily produced typical, pear-shaped, one-septate conidia of *Arthrobotrys*, while the other under the same conditions never was observed to produce anything else but the globular bodies and the rings. In Zopf's paper was described another fungus, producing hook-shaped conidia, *Harposporium Anguillulae*, parasitic on nematodes which is also clearly a different organism. Thus, so far as the writer is aware the fungus is new.

The families of the Fungi Imperfecti, as they are now described, are such that this new fungus could not be placed in any of them. However, it seems that it could be readily placed with the group of fungi producing spiral conidia, Helicosporae, if the description were properly emended.

In "Genera of Fungi," by F. C. Clements and C. L. Shear, page 209 (1931), the description of Helicosporae reading "Conidia spirally curved . . ." etc., should be emended to read: "Conidia spirally curved or in form of rings . . ." etc. And in the key, under paragraph B, should be added a third line as follows: "3. Conidia in form of closed rings . . . *Anulospodium*."

The fungus could not be placed in any of the described genera and therefore is considered to be a new genus with the following description:

¹ Zopf, Wilhelm. Zur Kenntnis der Infektions-Krankheiten niederer Thiere und Pflanzen. Nova Acta Leop. 52: 315-376. 7 pls. 1888.

Anulosporium gen. nov.

Hyphae septate, hyaline; conidia single, terminal, in shape of rings.

Anulosporium nematogenum sp. nov.

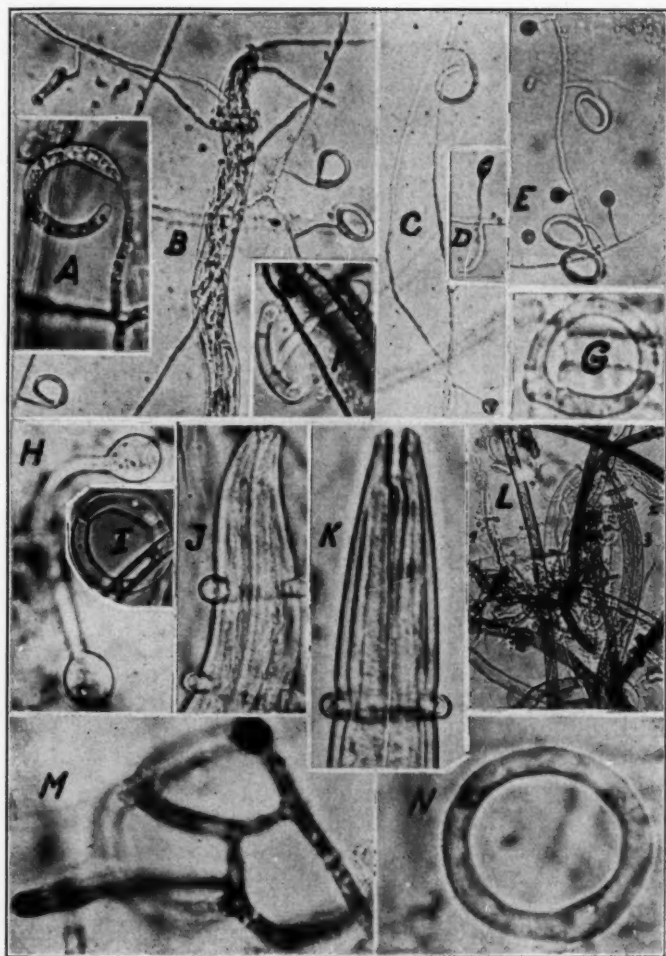
Hyphae septate, hyaline, 1.7–2.2 μ in diameter when they grow outside of the host, and 2.5–3.5 μ in diameter when they grow inside of the host; conidia with mostly indistinct septation though sometimes clearly, usually 3-septate, hyaline, 2.5–3.5 μ in diameter, forming rings 13–23 μ , mostly about 18 μ , outside diameter; conidiophores simple, sometimes septate, 20–30 μ long.

Hab. parasitic on various nematodes and on larvae of some minute flies, in association with strawberry plants, in Tennessee.

AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF TENNESSEE.

DESCRIPTION OF PLATE 35

Anulosporium nematogenum. A, a nearly completed development of the ring; 1000 \times . B, a nematode filled with the fungus growth, with two of the rings over the nematode's body still visible; and the growth outside of it, with two completed and two nearly completed rings; 400 \times . C, one of the globular bodies and one ring in the process of its development; 400 \times . D, a young conidium at the beginning of its development into a ring-shaped form; 400 \times . E, globular and ring-shaped stages, and the mycelium; 400 \times . F, a germinated ring, with the germ tube terminated in a globular conidium; 1000 \times . G, one of the rings; 1000 \times . H, two globular conidia; 1000 \times . I, a ring with well defined septa; 1000 \times . J, a nematode with two rings; 1000 \times . K, a nematode with one ring; 1000 \times . L: 1, a completely disintegrated nematode with the ring, in cross section, still visible; 2, a nematode filled with the fungus; 3, a still living nematode with three rings on it. A number of the rings could be detected in the field. 300 \times . M, a three-dimensional system of loops of *Arthrobotrys oligospora*; 500 \times . N, one of the rings highly magnified; 2000 \times .



ANULOSPORIUM NEMATOGENUM



OBSERVATIONS ON *LAGENA RADICICOLA*

J. H. L. TRUSCOTT¹

(WITH TEXT FIGURES)

Lagena radiculicola was reported first by Vanterpool and Ledingham² from a few localities in Saskatchewan. It is an obligate parasite of the roots of various cereals and wild grasses. The new genus was provisionally placed in the family Ancylistaceae and its possible relationship to the genus *Pythium* was noted.

The purpose of this paper is to report the occurrence of the fungus in soil from Vineland, Ontario, and to present some new observations on its morphology and host range.

The fungus was obtained from Vineland soil in the fall of 1931 on the hosts mentioned by Vanterpool and Ledingham, namely, wheat, barley, rye and maize, and during the summer of 1932 it was found in several fields in the Vineland district on *Agropyron repens* (L.) Beauv. and a number of other wild grasses.

A brief description of *L. radiculicola* is necessary for purposes of comparison. The vegetative phase consists of simple (FIG. 1) or lobed sacs suspended in the lumina of cortical cells of young rootlets. A definite neck (FIG. 1) connects the sac to the cell wall and marks the place where infection by a zoospore occurred. An exit tube (FIG. 2) grows out from the neck and at its distal end expands to form a vesicle into which flow the contents of the sac. Zoospores are delimited in the vesicle (FIG. 3) and are freed after its rupture. The zoospores are reniform and biciliate and the whole process of zoospore discharge resembles that of the genus *Pythium*. Structures similar to those which function as sporangia may function as gametangia. The contents of one sac passes through a conjugation tube into a second sac (FIG. 7) and a resting spore (FIG. 9) is produced in the latter. Germination of the resting spores has not been seen.

¹ This work was done during the tenure of a Bursary from the National Research Council of Canada, in the Laboratories of the Department of Botany, University of Toronto. I am indebted to Professors D. L. Bailey and H. S. Jackson for their interest and advice.

² Vanterpool, T. C., and G. A. Ledingham. Studies on "Browning" root rot of cereals 1. The association of *Lagena radiculicola* N. Gen.; N. Sp., with the root injury of wheat. Can. Jour. Res. 2: 171-194. 1930.

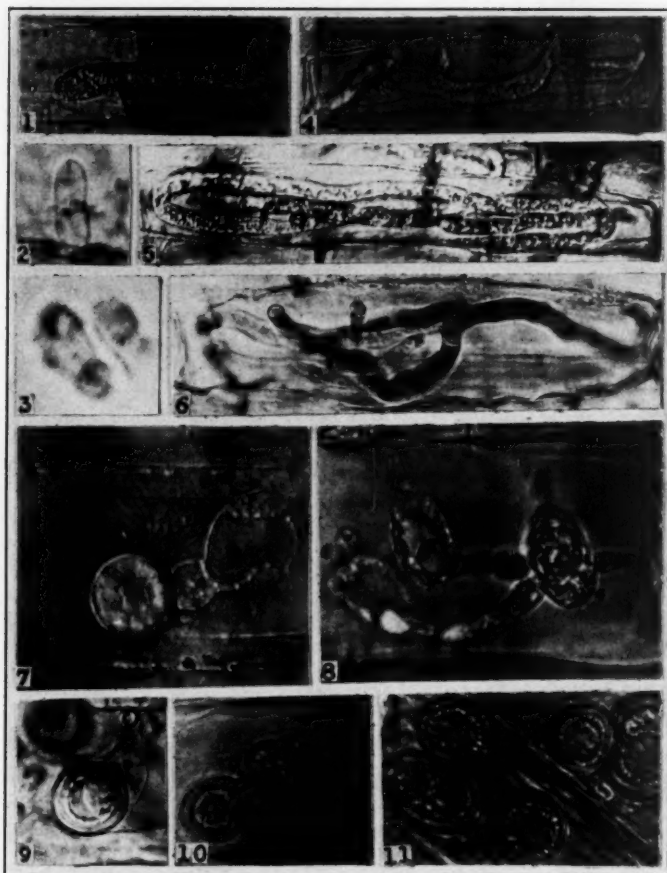


FIG. 1. A young sporangium of the Ontario *Lagena* showing the neck attaching it to the cell wall, $\times 470$; 2, an exit tube, $\times 1400$; 3, zoospores in motion inside a vesicle, $\times 1400$; 4, 5, and 6, variations in the form of sporangium of the Ontario fungus, $\times 470$; 7, a type of fertilization common to both the Ontario and the Saskatchewan forms of *Lagena*, $\times 1400$; 8, multiple fertilization in the Saskatchewan fungus. Two male thalli are in the act of fertilizing the female thallus (center) and a third male thallus has made contact with the female, $\times 1400$; 9, Ontario form showing a mature resting spore within a female thallus. The opening of the neck is shown, $\times 1400$; 10, a compound resting spore of the Ontario fungus, $\times 1400$; 11, forms of resting spores of the Ontario fungus, $\times 1400$.

The illustrations to which reference has been made are all of the Ontario fungus and a comparison with the figures published by Vanterpool and Ledingham will show how closely they agree. In the Ontario form however, the sporangia are *typically* branched (FIGS. 4, 5, 6). This character is so consistent that infections of Marquis wheat grown in Vineland soil may be distinguished readily from those obtained in the same host grown in Saskatchewan soil when both soils are under essentially the same conditions on a greenhouse bench.

While comparing the two forms in the living condition an example of multiple fertilization was noted for the first time in the Saskatchewan form. Figure 8 shows three male thalli in the process of fertilizing a single female thallus. Multiple fertilization has not been seen in the Ontario form, probably because the gametangia are usually so closely entwined that the chances of seeing the connecting tubes are small; but, evidence has been secured that more than one resting spore may be produced in a single female thallus. Rows of as many as six spores resting side by side suggest that they were borne in one gametangium, and in such cases the very thin wall of a gametangium may often be seen to at least partially enclose these spores. Figure 10 illustrates an unusual type of spore found thus far only in the Ontario fungus. One of these spores is compound: the wall between two of the components has not developed completely across the spore while the second cross wall is complete.

Numerous unsuccessful attempts to obtain these fungi in pure culture have been made by means of zoospore inoculations on the roots of a susceptible host grown under aseptic conditions. Until that is accomplished it is impossible to decide whether or not the differences between the Saskatchewan and Ontario forms of the genus *Lagena* have any taxonomic significance. It is quite possible that more than one species exist in both soils, but the branched and larger sporangium which is more typical of the Ontario form, intergrades so commonly with the smaller and unbranched sporangium usually seen in the Saskatchewan form, that it is thought unwise to attempt at present any taxonomic separation.

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SPECIES OF SCLEROTINIA FROM GRAND MESA NATIONAL FOREST, COLORADO

ROSS W. DAVIDSON AND EDITH K. CASH

(WITH PLATES 36-38)

This paper consists of some of the results of a collecting trip made by the senior author to the Grand Mesa National Forest, Colorado, during the period of June 12 to July 20, 1930. Although the fungi here discussed represent only a small percentage of the total number of collections, it seems that the species of *Sclerotinia* were sufficient in number and interest to justify a separate account.

The Grand Mesa National Forest is on the western slope of the Continental Divide in the west-central part of Colorado, and Grand Mesa Mountain, where most of the species of *Sclerotinia* were obtained, has sufficient moisture from melting snow and summer rains to make possible a rich fungus flora. Most of the fungi were found near the top of the mountain, at an elevation of about 10,000 feet; *Sclerotinia gregaria*, however, occurred approximately 2,000 feet lower, several miles down the mountain from Mesa Lakes.

It was not found possible to study the complete life history of any of these species, but a few observations were made on the imperfect stages of some of them. A *Botrytis* fruiting form appeared on sclerotia of *Sclerotinia Veratri* and *S. coloradensis* when they were placed in damp sand. This is not unusual as *Botrytis* has long been considered an imperfect stage of many of the species of *Sclerotinia*.

A more interesting observation was made in connection with the species on *Salix*. Green leaves infected with *Sclerotinia foliicola* in the sclerotial stage were found to have an associated imperfect spore form. This is very similar to the *Myrioconium comitatum* Davis (2), which is almost always found associated with *Sclerotium bifrons* on aspen and which has also been reported on *Salix*. The finding of a *Sclerotium* associated with *Myrioconium*

on *Salix* leaves strongly indicates that *Myrioconium* is an imperfect stage of certain species of *Sclerotinia*.

Mr. Ivar Tidestrom has kindly named the specimens of host material with the exception of the *Carex* species, which were determined by the late Dr. H. Hasselbring.

1. *SCLEROTINIA SCLEROTIORUM* (Lib.) DeBary. (PLATE 36, FIGS. 1-3.)

On *Mertensia lanceolata* (Pursh) DC., 388 and 397, June 20; 416, June 23; 445, June 26. Mesa Lakes.

On *Aconitum columbianum* Nutt., 389, June 20. Mesa Lakes.

This *Sclerotinia* was very common in the region on *Mertensia*, fruiting abundantly when first found on June 20 and continuing as late as July 12. In the old stems and among the rotting remains of plant tissue, the large solid sclerotia could easily be found. Frequently several discs occur on a single sclerotium.

It was definitely determined as occurring on the two hosts here given, but it is quite likely that a number of others are also affected. It is thought that it also occurs on the poisonous larkspur common in this region, but this was not definitely demonstrated, although sclerotia were observed on old stems of this plant. The fact that this fungus has been reported on so many herbaceous hosts might lead one to suppose that under favorable conditions it would occur on almost any herbaceous plants. However, observations in the vicinity of Mesa Lakes indicate that it is selective in this respect, for several hosts which grew side by side with *Mertensia* and just as abundantly, were not infected by the fungus. Sclerotia were planted in moist sand in the laboratory, but no conidial or ascus stages developed.

2. *Sclerotinia Veratri* Cash & Davidson, sp. nov. (PLATE 36, FIG. 4.)

The sclerotia are flat, elliptical to irregularly elongate, embedded in stems and, when infection is severe, diffused over considerable area, dark reddish brown to black, white within, 3-7 mm. long by 1-3 mm. broad and 1 mm. thick; apothecia reddish brown, cupulate at first, with inrolled margins, becoming almost flat, usually 3-7 mm. broad, sometimes larger, up to 1 cm., wrinkled when dry, hymenium brown, becoming lighter grayish brown at maturity; stipe black, swollen toward the base, 0.5-1

cm. long by 0.5–1 mm. thick; asci cylindrical, attenuated near base, wall thickened at apex, $140\text{--}150 \times 11\text{--}13 \mu$; spores irregularly uniseriate, unicellular, biguttulate, oblong-elliptical, hyaline, $15\text{--}17.6 \times 5\text{--}6.5 \mu$; paraphyses filiform, septate, simple or branched near the base, pale brown, $2\text{--}2.5 \mu$ at apex.

Sclerotii applanatis, ellipticis vel elongatis, nigro-brunneis, in caulibus immersis, intus albidis, 3–7 mm. longis, 1–3 mm. latis, 1 mm. crassis; conidiis $13\text{--}17 \times 5\text{--}7.5 \mu$ in sclerotiis cultis; apotheciis rufo-brunneis, primitus cyathiformibus, margine incurvato, denique patelliformibus, plerumque 3–7 mm., interdum 1 cm. diam., disco griseo-brunneo; stipite nigro, versus basim inflato, 0.5–1 cm. longo, 0.5–1 mm. diam.; ascis cylindricis, base attenuatis, apice incrassatis, $140\text{--}150 \times 11\text{--}13 \mu$; sporis irregulariter uniseriatis, simplicibus, oblongo-ellipticis, hyalinis, biguttulatis, $15\text{--}17.6 \times 5\text{--}6.5 \mu$; paraphysibus filiformibus, septatis, simplicibus vel ad basim ramosis, dilute brunneis, apice $2\text{--}2.5 \mu$ crassis.

On *Veratrum californicum* Durand, 390 (type) June 20, on the south shore of Mesa Lakes Reservoir, around pools of cold spring water; 392 (sclerotia) same data.

The sclerotia were noticed frequently on old stems but the perfect stage was seldom found and then under only the most ideal conditions.

A species of *Botrytis* with spores $13\text{--}17 \times 5\text{--}7.5 \mu$ developed on sclerotia that were placed in damp sand.

3. *Sclerotinia coloradensis* Cash & Davidson, sp. nov. (PLATE 38, FIG. 12.)

Sclerotia on stems and seed pods were thin, flat, elongated, sometimes confluent, black, white within, 0.2–3 cm. long, 2–5 mm. broad, 0.5 mm. thick, inconspicuous on weathered material. Apothecia one to several from each sclerotium, cup-shaped, becoming flat, pale brown, 2–3.5 mm. in diameter, hymenium pale brown, margin thin, inrolled when dry; stem brown, $4\text{--}7 \times 0.5$ mm.; asci cylindrical, blunt and thick walled at apex, short-pedicellate, $135\text{--}155 \times 7.5\text{--}9.5 \mu$; paraphyses filiform, septate, unbranched, 2.5μ at apex; spores unicellular, elliptical, hyaline, $10\text{--}12 \times 4\text{--}5 \mu$.

Sclerotii tenuibus, applanatis, elongatis, interdum confluentibus, nigris, intus albidis, 0.2–3 cm. longis, 2–5 mm. latis, 0.5 mm. crassis; apotheciis singulis vel pluribus ex quoque sclerotio, cyathiformibus vel patelliformibus, pallide brunneis, 2–3.5 mm. diam.; hymenio pallide brunneo, margine tenui, sicco incurvato; stipite brunneo, aequale, $4\text{--}7 \times 0.5$ mm.; ascis cylindricis, apice obtusatis et incrassatis, breviter pedicellatis, $135\text{--}155 \times 7.5\text{--}9.5 \mu$; paraphysibus filiformibus, septatis, non ramosis, apice 2.5μ crassis; sporis simplicibus, hyalinis, ellipticis, $10\text{--}12 \times 4\text{--}5 \mu$.

On *Pedicularis groenlandica* Retz., 517, July 3; 525 (type), July 7, on top of Grand Mesa.

On *Pedicularis bracteosa* Benth., 536 (sclerotia), July 8, at Mesa Lakes.

The type specimen was collected on boggy meadows not far from the road leading from Mesa Lakes to Alexander Lakes. The sclerotia, which occurred abundantly on all of the old stems, were first noticed on June 25, at which time none could be found in fruiting condition. Some of the sclerotia were taken to camp and an attempt made to induce fruiting, but an imperfect (*Botrytis*) stage was all that appeared. Eight days later a second trip was made to the top of Grand Mesa and the perfect stage found.

The thin, flattened sclerotia of this Colorado material are entirely unlike those of *Sclerotinia sclerotiorum*, the only species reported on Scrophulariaceae from North America, and the apothecia are much smaller.

4. *Sclerotinia foliicola* Cash & Davidson, sp. nov. (PLATE 37, FIGS. 8-9.)

Sclerotia surrounding mid-rib of over-wintered leaves, 1-4 cm. long by 0.5-1 mm. thick, the black cortex surrounding the mid-rib and extending through the leaf blade on each side, sclerotial cells intermixed with host tissue; apothecia at first cupulate, becoming almost flat at maturity, up to 1 cm. in diameter, grayish brown, hymenium paler, exterior slightly roughened, margin thin, inrolled when dry; stem brown, darker at base, 1-3 cm. \times 0.5-1 mm., rather stout when young, becoming slender at maturity; asci cylindrical, gradually attenuated at base, 120-140 \times 8-10 μ , apex truncate, pore blue with iodine; spores uniseriate, unicellular, elliptical, hyaline, 9-13 \times 5.5 μ ; paraphyses filiform, septate, unbranched, gradually enlarged to 3-4 μ at tip; exciple of hyaline prosenchyma becoming brownish and larger celled at cortex.

Sclerotii nigris, nervos foliorum vetustorum circumvallentibus, 1-4 cm. longis, 0.5-1 mm. crassis; apotheciis initio cupulatis, dein fere patelliformibus, usque 1 cm. diam., cinereo-brunneis, hymenio pallidior, extus leniter rugulosis; margine tenui, sicco involuto; stipite brunneo, basim versus obscuriore, 1-3 cm. \times 0.5-1 mm., in juventute robustis, in maturitate tenuioribus; ascis cylindricis, ad basim paulatim attenuatis, 120-140 \times 8-10 μ , apice truncato, poro ope iodi coerulescente; sporis uniseriatis, simplicibus, ellipticis, hyalinis, 9-13 \times 5.5 μ ; paraphysibus filiformibus, septatis, non ramosis, apice paulatim 3-4 μ incrassatis; excipulo hyalino, prosenchymatico, cortice brunneo et magno-cellulari.

On *Salix* sp., 384 (type), June 20, Mesa Lakes; 422, June 24, Buzzard Creek; 758, July 22, Pinion Mesa (sclerotia and *Myrioconium*).

Sclerotinia rathenowiana Kirschst. (Rehm. Ascom. No. 1649) which was found on *Salix* twigs in Germany, has sclerotia emerging from beneath the bark, and differs in appearance and size from the Colorado species. The apothecia of *Ciboria filipes* Henn. on *Salix* leaves are much smaller (0.5–1 mm. diam.).

A species of *Myrioconium* found along the veins of the leaves in association with sclerotia is apparently the imperfect stage of this fungus.

5. *SCLEROTINIA GREGARIA* Dana. (PLATE 38, FIGS. 10–11.)

On *Amelanchier* (*alnifolia*?), 665, July 14, several miles down mountain from Mesa Lakes.

While examining a collection of *Ciboria Johnsonii* Ellis & Ev. on fruits and leaves of *Amelanchier*, it was noticed that several of the fruits contained lighter colored apothecia which grew from black sclerotia. Microscopical examinations showed that this was *Sclerotinia gregaria* Dana. The apothecia were clustered as described for this species.

The *Ciboria* occurred scattered through the thick damp leaf mold under *Amelanchier* and scrub oak timber.

6. *Sclerotinia fallax* (Sacc.?) Cash & Davidson, comb. nov.

? *Sclerotium fallax* Sacc. Nuovo Giorn. Bot. Ital. n. s. 23: 197, 1916.

Sclerotia on leaf 0.3–2 mm. long by 1 mm. wide and 0.5 mm. thick, falling out and leaving hole in leaf; apothecia small, patellate, 1–1.5 mm., pale brown, long-stipitate, stipe up to 1.4 cm. long; asci four-spored, cylindrical, apex rounded, attenuated at base, $55 \times 5-6 \mu$; spores uniseriate in upper half of ascus, unicellular, elliptical, narrower at lower end, $9-12 \times 3-4 \mu$; paraphyses filiform, septate, unbranched, 2 μ thick.

Sclerotii 0.3–2 mm. longis, 1 mm. latis, 0.5 mm. crassis, ex foliis secedentibus; apotheciis parvis, patelliformibus, 1–1.5 mm. diam., pallide brunneis, longe stipitatis, stipite usque 1.4 cm. longo; ascis 4-sporis, cylindricis, apice rotundatis, base attenuatis, $55 \times 5-6 \mu$; sporis in parte superiore ascorum monostichis, simplicibus, ellipticis, apice inferiore angustioribus, $9-12 \times 3-4 \mu$; paraphysibus filiformibus, septatis, non ramosis, apice 2 μ crassis.

On *Potentilla* sp., 476, July 1, Mesa Lakes.

At the time this specimen was collected it was almost impossible to determine the host on which it occurred. The apothecia were found for the most part on well rotted leaf mold close to a cold mountain stream. However one leaf which was lying very close to the water and which bore a number of apothecia was sufficiently preserved for a host determination.

The only similar organism that has been described on *Potentilla* or closely related hosts is *Sclerotium fallax* Sacc., on leaves of *Potentilla canadensis* from Spencertown, N. Y. (Saccardo 3, p. 197.) No material of the Saccardo species was available for comparison, but from the description it seems probable that it is the same. Some sclerotia in the Colorado specimen were larger than described for *S. fallax* and in this material they were amphigenous.

7. *Sclerotinia paludosa* Cash & Davidson, sp. nov. (PLATE 37, FIGS. 6-7.)

Sclerotia on leaves, often on edges, small, inconspicuous, 0.3-1 mm. in diameter, sometimes elongated up to 1.7 mm., black; apothecia brown, small, cupulate then becoming almost plane, 1.2-2 mm. broad, stipe 3-4 \times 0.3 mm.; asci cylindrical, attenuated at base, with short pedicel, truncate above, pore faintly blue with iodine, 150 \times 10-12 μ ; paraphyses numerous, filiform, septate, agglutinated and brown at tip, measuring 1-4 μ ; spores 1-2 seriate, one-celled, biguttulate, contents granular, 12-14 \times 5 μ .

Sclerotii foliicolis, parvis, 0.3-1 mm. diam., interdum usque 1.7 mm. longis, nigris; apotheciis brunneis, parvis, calyciformibus vel fere patelliformibus, 1.2-2 mm. diam.; stipite 3-4 \times 0.3 mm.; ascis cylindricis, ad basim attenuatis, breve pedicellatis, apice truncatis, poro dilute jodo coerulescente, 150 \times 10-12 μ ; paraphysibus numerosis, filiformibus, septatis, apice brunneis et coalescentibus, 1-4 μ diam.; sporis uniseriatis vel biseriatis, simplicibus, biguttulatis, intus granulosis, 12-14 \times 5 μ .

On overwintered leaves of *Carex exsiccata* Butler, 436 (type), June 25, on top of Grand Mesa; 443, 446, June 26, at Mesa Lakes; 459 (sclerotia), June 27, on top of Grand Mesa.

This *Sclerotinia* was found on top of Grand Mesa in marshy meadows the same day and about the same place as the following one on *Carex* seeds. The host however seemed to be a different and less common species of *Carex* and the organism was much more difficult to find than the following, *S. paludosa* always being found in very wet, soggy spots, while *S. utriculorum* occurred abundantly in broad expanses of damp meadows.

The sclerotia are very indistinct after formation of the apothecia, all of the fungus tissue seeming to go into the formation of the perfect stage.

This fungus does not agree with any described on Cyperaceae. In size of asci and spores it is close to *S. duriaeana* Tul., which is reported on *Carex* in Europe and North America, but sclerotia of the latter are in the interior of stems and much larger and more conspicuous. The apothecia of the latter are also very much larger.

This and the following species are doubtfully placed in the genus *Sclerotinia*, as the sclerotia are very indistinct. The sclerotia here described were collected in a drier locality and the apothecia, therefore, were found only where water stood almost continually, so it could not definitely be shown that they are identical.

8. *SCLEROTINIA UTRICULORUM* Boud. (PLATE 36, FIG. 5.)

On seeds of *Carex athrostachya* Olney, 435, June 25, on top of Grand Mesa; 443 and 474 at Mesa Lakes, June 26 and July 1, respectively.

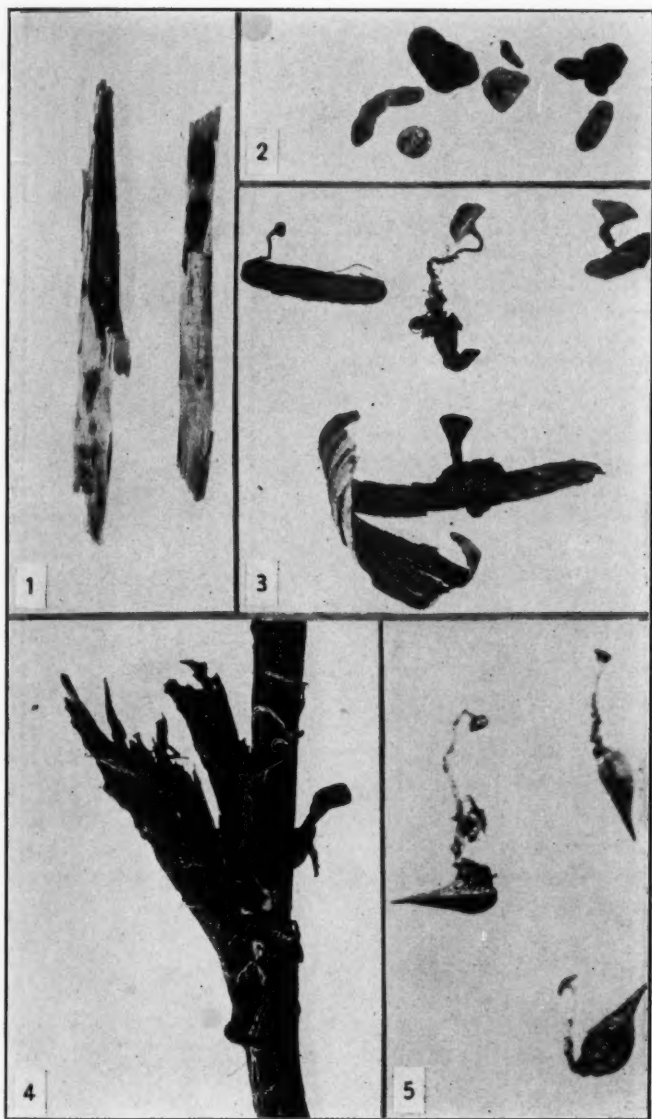
This attractive little species is not easily seen unless one is looking for it. However in this region it is widespread and very abundant, seeming to occur on almost all of the seeds in the particular plots examined.

It agrees very well with description and illustrations of *S. utriculorum* Boud. (1, p. 196, *pl. 8, fig. 6*) except that the asci and more irregularly shaped spores are smaller. The spores in this material are larger at one end and attenuated into a slightly curved elongation at the other.

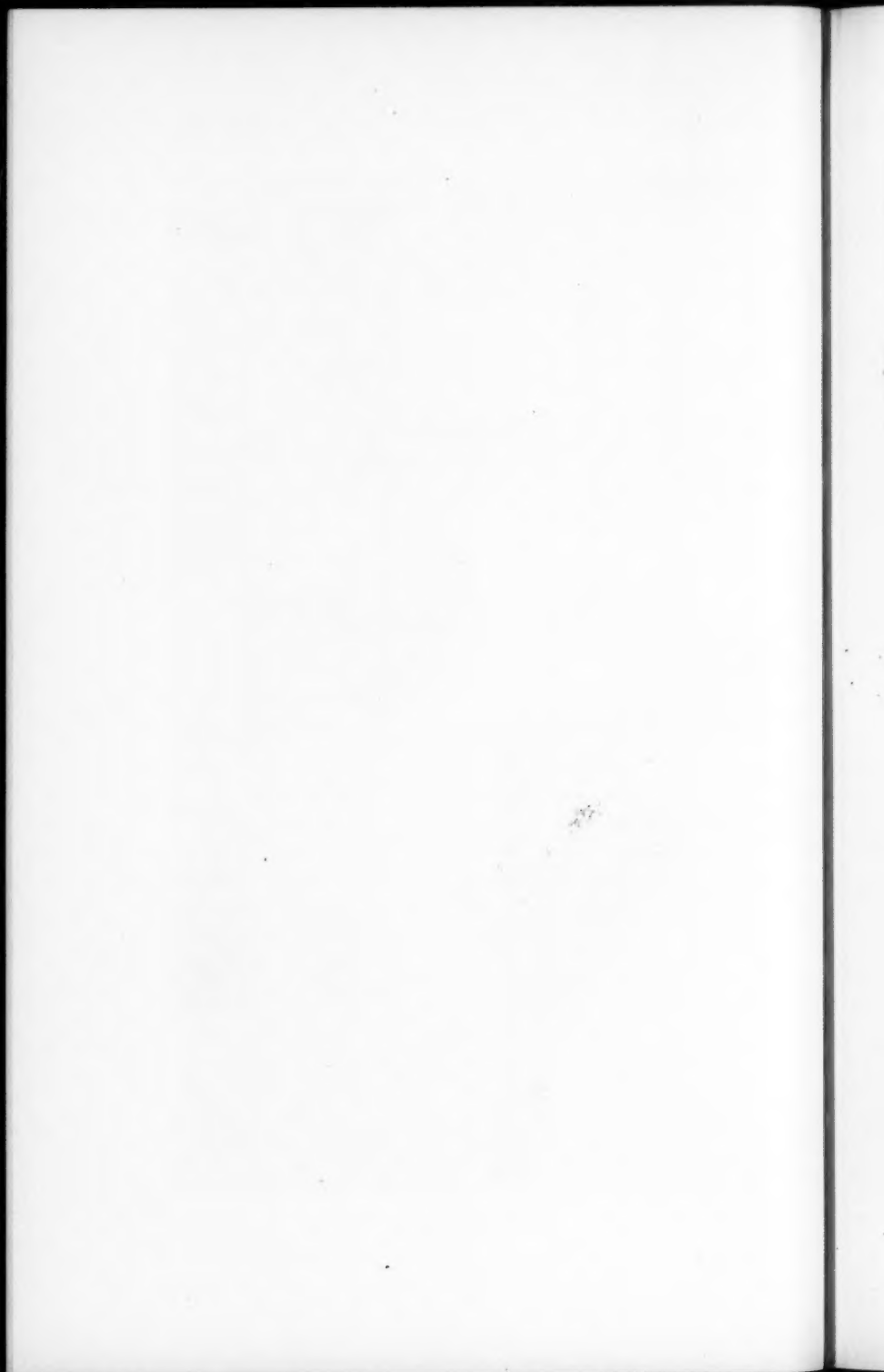
BUREAU OF PLANT INDUSTRY
WASHINGTON, D. C.

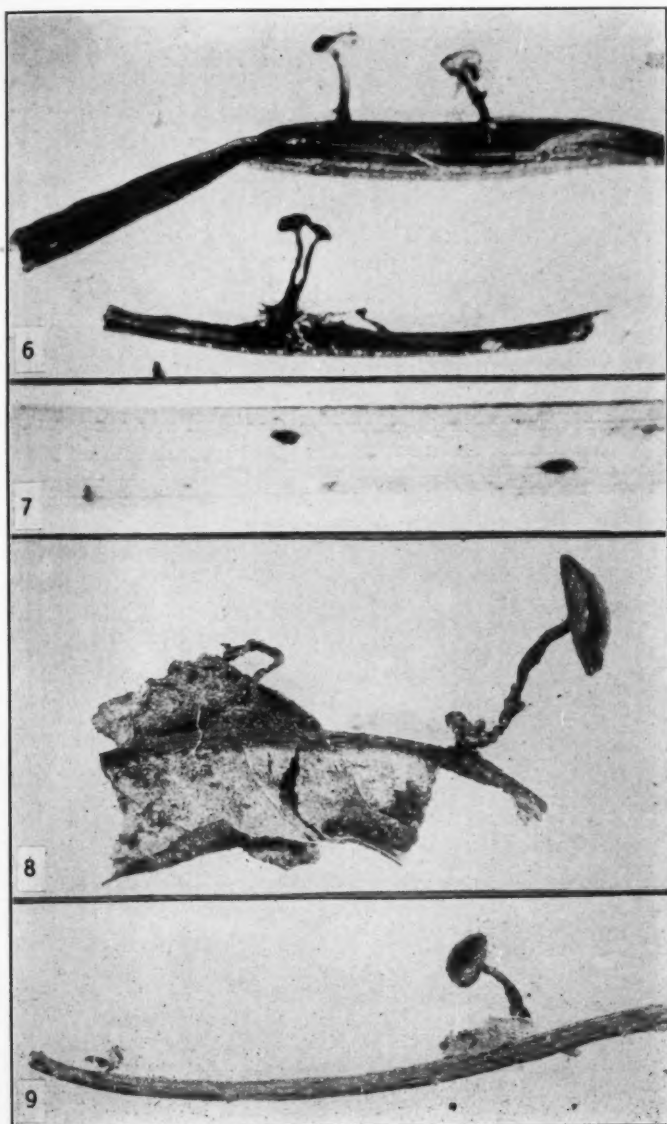
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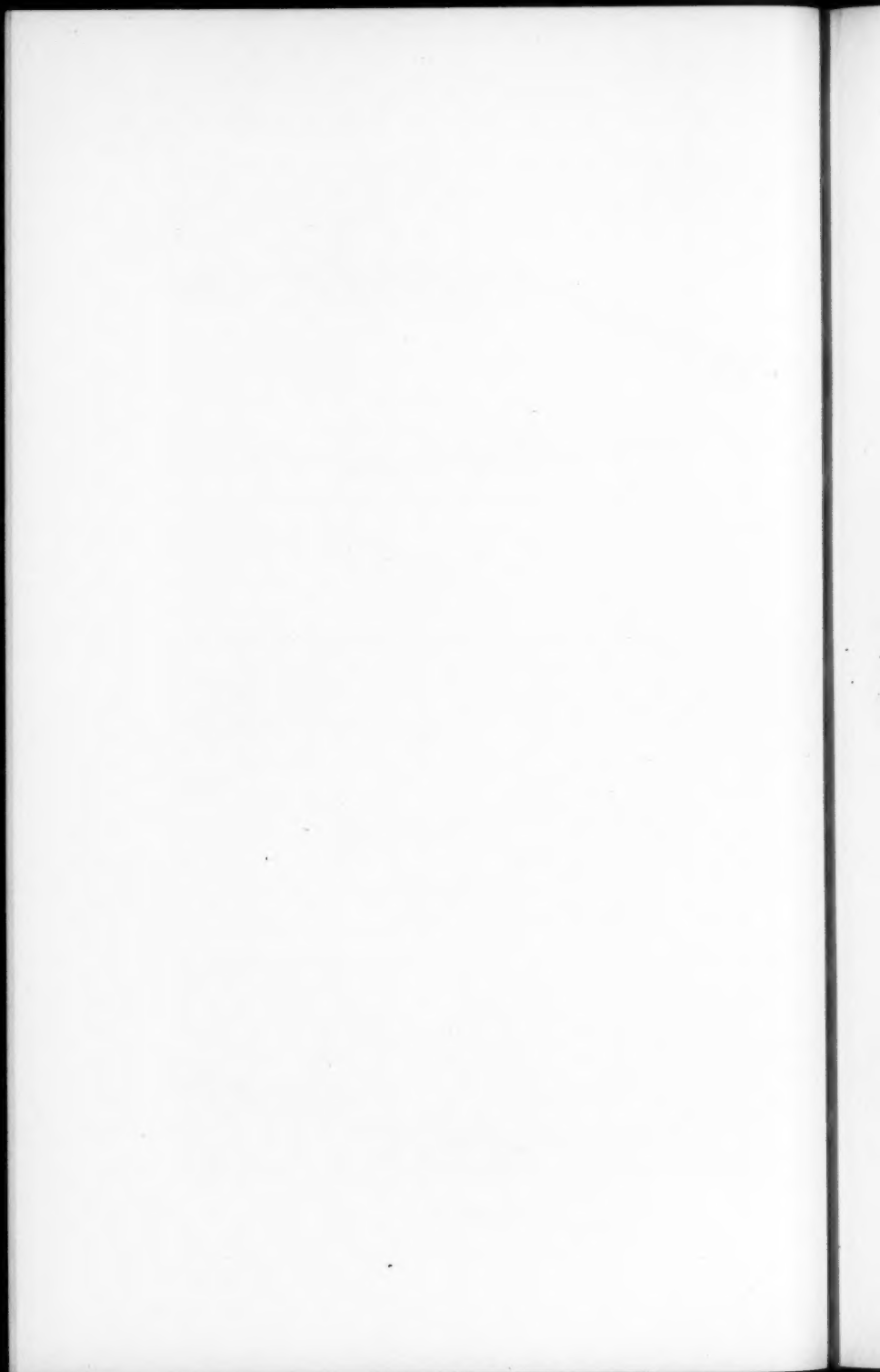


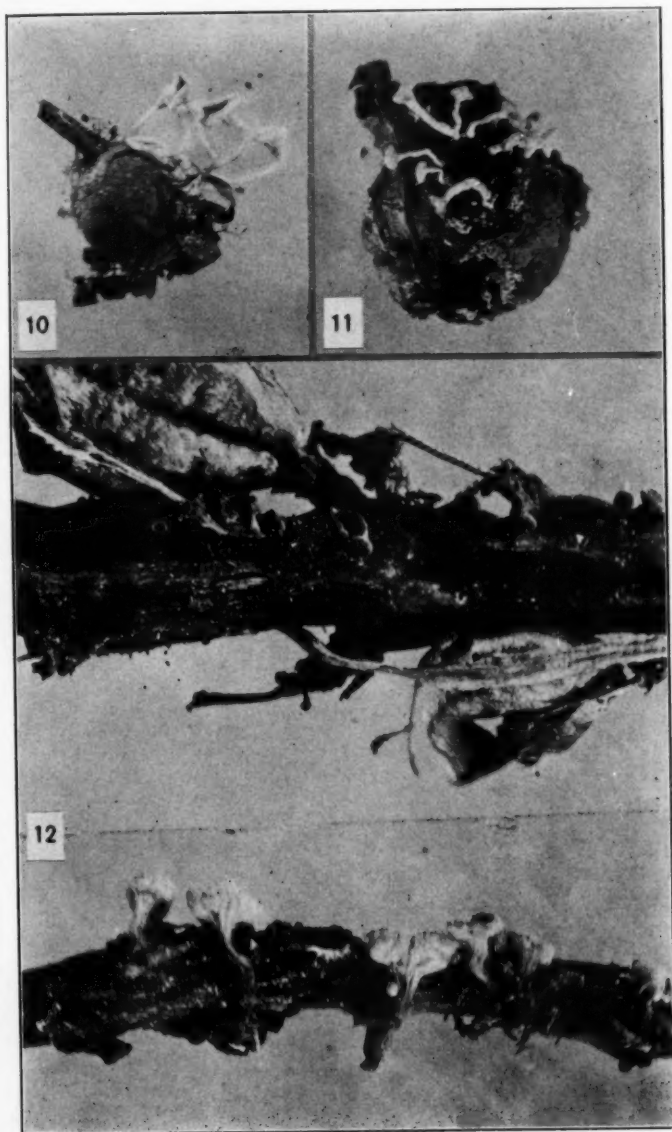
SCLEROTINIA





SCLEROTINIA





SCLEROTINIA



EXPLANATION OF PLATES

PLATE 36

Figs. 1-3, *Sclerotinia sclerotiorum* on *Aconitum*; 1, sclerotia in stems, $\times 1$; 2, sclerotia, $\times 1$; 3, apothecia growing from sclerotia, about $\times 2$; fig. 4, *Sclerotinia Veratri*. Apothecia on stem of *Veratrum californicum*, $\times 2$; fig. 5, *Sclerotinia utriculorum* Boud. Apothecia growing from *Carex* seed, $\times 5$.

PLATE 37

Figs. 6-7, *Sclerotinia paludosa* on *Carex*, $\times 5$; 6, apothecia on leaves; 7, sclerotia; figs. 8-9, *Sclerotinia foliicola* on *Salix*. Apothecia and sclerotia, $\times 5$.

PLATE 38

Figs. 10-11, *Sclerotinia gregaria*. Apothecia on fruit of *Amelanchier*, $\times 5$; fig. 12, *Sclerotinia coloradensis*. Apothecia and sclerotia on stems of *Pedicularis*, $\times 5$.

Photographs made by J. F. Brewer.

LIFE HISTORIES OF TRYBLIDIELLA SPECIES

C. L. SHEAR

(WITH 5 TEXT FIGURES)

The genus *Tryblidiella* was described by Saccardo (7) to include a group of Discomycetes having brown spores with two or more septa. This genus has been referred by some authors to the Hysteriaceae, but the plants are quite different in structure from typical members of that group. The species have rather large, thick, coriaceous apothecia which when fresh and moist are distinctly discoid, but when dry the margins of the apothecia roll inward covering most of the disk and giving the plants a superficial hysteroid appearance (FIG. 1, A AND B). The species of Saccardo were included by Ellis and Everhart (3) and some other authors under *Tryblidium*. The name, *Tryblidium*, as originally used by Rebentisch, 1805 (5), had as its type *T. calyciforme*, Rebent., which has hyaline muriform spores, and more or less regular apothecia with the margin irregularly torn. Later, Dufour, 1828 (2), referred to this genus a new species, *Tryblidium hysterinum*, which is quite different from Rebentisch's type, and belongs to an entirely different genus. Saccardo (8), however, in using the name, *Tryblidium*, took as the type Dufour's species which has one-septate brown spores, differing in this respect only from the genus *Tryblidiella*, which has two or more septate brown spores. Rehm has quite properly applied the name, *Tryblidium*, to the original type of Rebentisch, and included the one-septate spored species under *Tryblidiella*, which seems to be a natural arrangement. Rehm (6) published a revision of this and related genera in 1904, dividing the genus into two sections, *Eutryblidiella*, with spores one-septate, and *Rhydi-hysterium*, with spores three to five-septate.

No studies of the life history of this genus have heretofore been made so far as we know, nor any suggestion as to the existence of a pycnidial form. This is perhaps in part due to the fact that no pycnidia are usually found associated with apothecia of

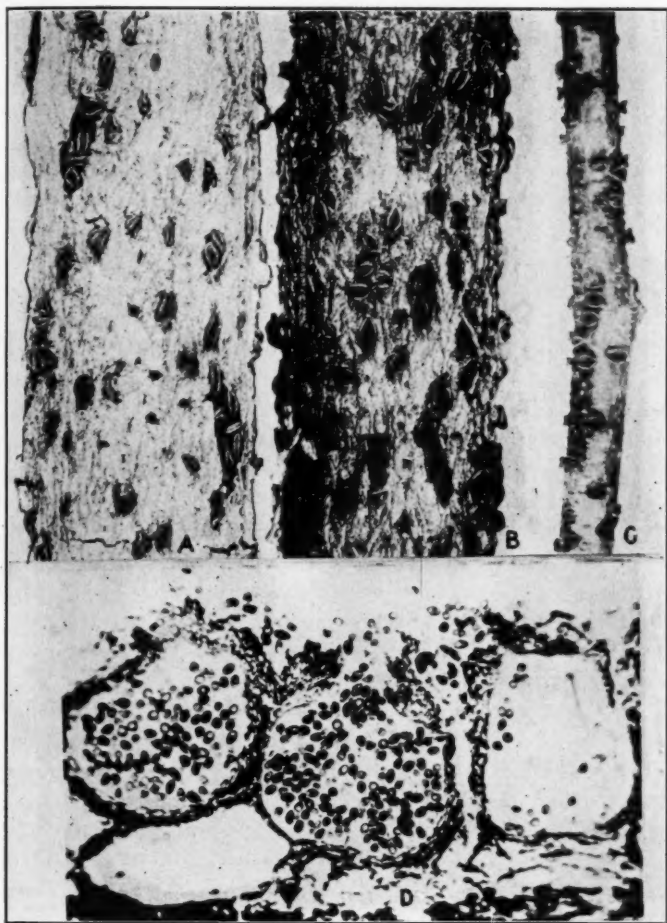


FIG. 1. (A), Apothecia of *Tryblidiella hystericina* on *Ilex vomitoria*, dried specimen; (B), portion of the same specimen moistened, apothecia open; (C), *Tryblidiella rufula?* on Black Cherry, moistened, showing open apothecia. All $\times 2.6$; (D), section of pycnidia (*Diplodia*) from single ascospore culture of *T. rufula?* from *Rhus* grown on sterile grape shoots, $\times 130$. Photomicrographs by J. F. Brewer.

Tryblidiella. The few pycnidia we have found with them do not agree with the forms produced in cultures, but belong to *Physalospora*.

We first began our studies of these fungi in 1923. Apothecia of *Tryblidiella* (specimen No. 1559) which agree very well with the description of *T. Leprieuri* (Mont.) Sacc. were found on dead branches of tea plants kindly sent us by Mr. A. C. Tunstall, Mycologist, of the Indian Tea Association. Cultures were made from single ascospores from one of these which grew well on cornmeal agar, producing a growth very similar in appearance to that of species of *Physalospora*. Transfers made to cornmeal in flasks soon produced, much to our surprise, *Diplodia*-like pycnidia having smooth brown, mostly one-septate spores, $20-25 \times 9-11 \mu$ (FIG. 4, B, AND FIG. 5, B). Later, what was still more unexpected, apothecia with ascospores of *Tryblidiella* appeared in one of the flasks. These agreed with the original specimens from which the cultures were made, except that the ascospores apparently did not reach full size and maturity (FIG. 2, D). No microspores were observed in these cultures, but they might very easily have been overlooked.

Later on during various collecting expeditions in Florida and other southern states where species of this genus are common, specimens were collected on various hosts and single ascospore cultures were made as follows:

First, from a species which agrees well with the description of *T. rufula* (Spreng.) Sacc. found on dead *Rhus* sp. at Monticello, Fla., No. 3917. These cultures first produced micropycnidia with hyaline subglobose microspores $2-3 \mu$ in diameter (FIG. 3, A). A little later pycnidia of a *Diplodia*-like form, having broadly striate, mostly one-septate, brown spores, $16-19 \times 10-12 \mu$ developed (FIG. 4, A). These spores resemble those of *D. Theobromae*, in everything but size (FIG. 5, A).

A little later, single ascospore cultures were made from apothecia on black cherry, *Prunus serotina*, No. 3916, which seemed to belong, according to their general morphological characters and spore measurements, to the same species of *Tryblidiella* as that found on *Rhus* in the same locality. These specimens were at first referred to *T. rufula* (Spreng.) Sacc., but since ascospores

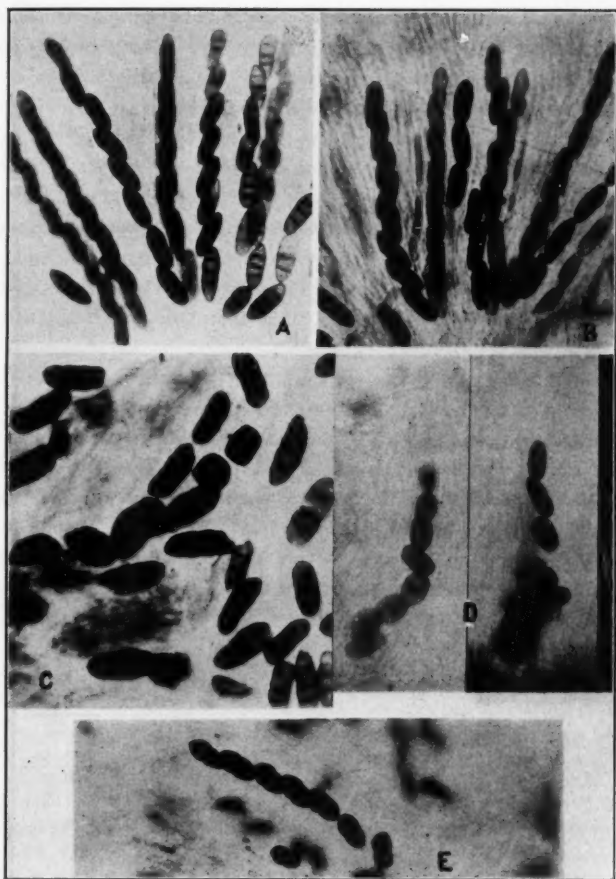


FIG. 2. (A), asci and ascospores of *Tryblidiella rufula?* No. 3917 from *Rhus*; (B), asci and ascospores of *T. rufula?* No. 3916 from Black Cherry; (C), ascospores of *T. Leprieuri* No. 1559 from tea, India; (D), asci and ascospores from pure culture of *T. Leprieuri* from tea, on cornmeal; (E), ascus and ascospore of *T. hysterina* No. 5813 from *Ilex*. All $\times 283$.

from the two hosts give different *Diplodia*-like species it remains for the present doubtful which, if either, is true *T. rufula*. These cultures had the same general appearance as the preceding and produced both pycnidia with hyaline subglobose microspores (FIG. 3, B), and later *Diplodia*-like pycnidia and spores. These spores were brown, mostly one-septate, $15-18 \times 6-9 \mu$, and scarcely distinguishable from spores of *Diplodia Mori*, according to Dr. N. E. Stevens, who kindly compared them (FIG. 5, C). Single ascospore cultures were also made from a specimen identified as *T. rufula*, collected by Dr. G. W. Carver on *Melia* at Tuskegee, Ala., our No. 3906. These cultures produced micro- and macropycnosporos agreeing with those obtained in culture from the specimens on black cherry.

Though the pycnosporos are distinctly different in the cultures of *T. rufula*? from *Rhus* and from cherry (see measurements and figures) the apothecia and ascospores from which they came do not seem to be distinguishable, and the species can only be separated at present on the basis of their pycnidial character, as is the case in some species of *Physalospora*. These results suggest that it may be necessary to know the pycnidial forms of our species of *Tryblidiella* in order to determine them with certainty.

Later, a collection was made on *Ilex vomitoria*, on Smith's Island, N. C., No. 5813, which agreed with the descriptions of *Tryblidiella hysterina* (Duf.) comb. nov. (*T. elevata* (Pers.) Rehm¹).

¹ The use of this name by Rehm and others is an excellent example of the perpetuation of an error by continuous copying of a mistake or misinterpretation without verification of citations. The name *Hysterium elevatum* Pers. first appeared in print as a synonym of *Tryblidium hysterinum* in Dufour's article, l.c., with the citation "Myc. Eur. Tab. 1, fig. 4 (Mala.)." A thorough examination of Persoon's work cited shows that by some error of omission there is no description or mention of any such species in the text and no reference to his figure. The name therefore dates from Dufour's use of it as a synonym l.c. The way the name *elevatum* originated seems to be indicated by Dufour's notes and observations, following his description. He says "Obs. Je ne pourrais douter du synonyme cité de Persoon, quoique la description de cet auteur n'accompagne pas la figure inexacte qu'il en a donnée, parce que je lui ai communiqué dans le temps des échantillons de mon espèce." This indicates apparently that Persoon's illustration was made from a specimen sent him by Dufour, as he states in a preceding paragraph that he collected abundant specimens of the fungus in 1814 and Persoon's book was not published until 1822. The natural inference would be that Persoon gave him the name *Hysterium elevatum* in a letter and had an illustration made of the specimen but omitted the description and name. Persoon's name *elevatum* has therefore no priority over *hysterinum*.

This is the species with one-septate ascospores (FIG. 2, E). Single ascospore cultures from this material produced *Diplodia*-like pycnidia only. No micropycnidia with hyaline spores, such as were found in the two other cases mentioned were seen, but these might easily have been overlooked as they were found in the next series. The *Diplodia*-like spores were very variable in shape and size, ranging from $15-23 \times 9-12 \mu$, average about $20 \times 10 \mu$ (FIG. 5, D). They resemble in shape and character *Diplodia Alni* Fuckel, whose perfect stage is unknown. Ascospore cultures have also recently been made from *T. hysterina* on *Ilex vomitoria* from Alabama, No. 3907. These produced micro- and macropycnidia and spores agreeing rather closely in size, shape and general character with those obtained in culture from the same host collected on Smith's Island.

The *Diplodia*-like pycnidia produced from ascospores from three of these collections and hosts show differences in size, shape and markings of the pycnospores which would, according to present ideas of classification, place them in different species. Pycnospores from tea have the same general size and shape as those of *D. natalensis* or *D. Theobromae*, but they do not show the longitudinal striae characteristic of that species. Of the other species with which it has been compared, it seems closest to *D. vulgaris* Lév., whose perfect stage is not known. The cultures from apothecia on *Rhus*, as already stated, resemble *D. Theobromae* in everything but size. *D. Theobromae* according to our present interpretation is the same as *D. natalensis*, which has been proven to be the pycnidial stage of *Physalospora*.

In all of the cultures made from *Tryblidiella*, the general character and appearance of the *Diplodia*-like pycnidia and spores are the same as in those made from species of *Physalospora*. It seems rather remarkable at first thought that the pycnidial forms of such widely separated genera as *Tryblidiella* and *Physalospora* should be so similar as to be referred to the same form genus, *Diplodia*. It is probable, however, that when we come to compare more thoroughly all of the characters of these pycnidial forms throughout their development, sufficient differences may be found to separate generically the species having such widely different perfect stages.

Pycnidial forms of *Physalospora* are variable in many respects especially as to the formation of stromata. Some produce micropycnospores and frequently so-called paraphyses are found.



FIG. 3. (A), section of micropycnidium and spores from a single ascospore culture of *T. rufula?* from *Rhus*, on cornmeal; (B), micropycnidium and spores from a single ascospore culture of *T. rufula?* from Black Cherry on cornmeal. Both $\times 130$.

Thus far we have not seen these so-called paraphyses in the pycnidia produced by *Tryblidiella*.

If one should accept the method of segregation of genera adopted by Petrak and Sydow (4) for this group of pycnidial

forms those considered here might easily be referred to different form genera; but until we know more about the value of the criteria used, the range of variability of the characters and the life histories of the fungi, it is doubtful whether such efforts would be worth while. In this connection it is interesting to compare figure 1, D, with figure 4, A and B, noting the difference in the character of the pycnidial walls in the first, which were grown on sterile grape twigs, and the second grown on cornmeal.

We had at one time hoped that the conidial forms of the Ascomycetes when definitely connected with their perfect stages would provide a means of segregating some of the genera with more certainty. In that respect the results of our study of *Tryblidiella* are rather disappointing. Many mycologists, however, who have not made life history studies in this group may have accepted the view of Fuckel, Tulasne, Saccardo and others, who were apparently not at all disturbed by the heterogenous pleomorphism indicated by the association of pycnidial forms of the same genus with very diverse ascogenous genera to which they believed they were genetically related. Saccardo, for example, in his *Sylloge Fungorum* gives *Diplodia* as the pycnidial form of species of *Cucurbitaria*, *Massaria*, *Othia*, *Melanomma*, *Pleospora*, *Thyridaria* and *Gibberidia*. There are probably other genera also given, as we have not attempted to make a complete list.

In the case of *Thyridaria*, Bancroft (1) states that he has obtained *Diplodia* in pure cultures from ascospores and Tunstall (10) has confirmed this work. In the other genera mentioned the connection has not been demonstrated by pure cultures so far as known, except in the case of *Cucurbitaria*, one species of which we have just proven has *Diplodia*-like pycnidia. This will be discussed in a later paper.

In the past the taxonomy of the Ascomycetes has been based generally on the belief that the ascocarps possess the distinctive morphological characters by which they can be segregated into genera and species and the conidial forms, even when positively known, have been regarded as having little or no generic significance.

It may possibly develop that the various conidial and pycnidial forms found have no more taxonomic significance than that of the

vegetative forms of reproduction which occur in other groups of plants, such as bulbs, bulbils, tubers, gemmae or sclerotia. However, the greater complexity and differentiation of parts of many

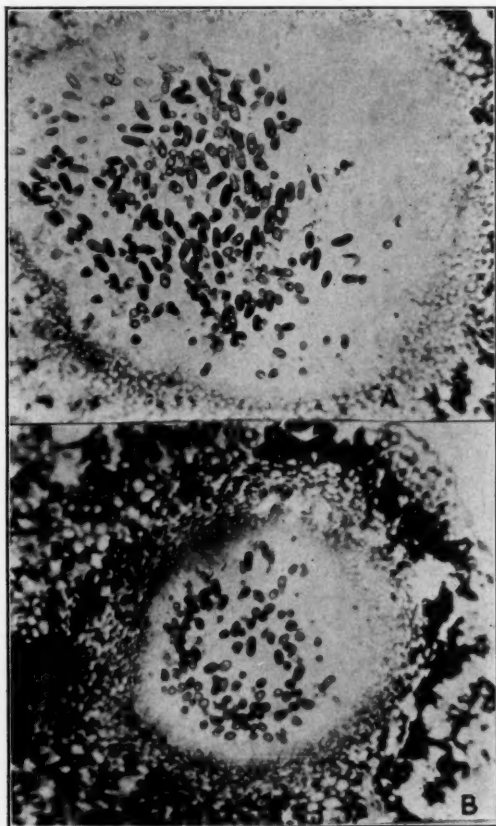


FIG. 4. (A), section of macropycnidium (*Diplodia*) from a single ascospore culture of *T. rufula?* from *Rhus*, on cornmeal; (B), section of macropycnidium (*Diplodia*) from a single ascospore culture of *T. Leprieuri*, from tea, on cornmeal. Both $\times 130$.

pycnidial forms suggests that they may have greater taxonomic significance than the vegetative organs mentioned. See Shear (9) for further discussion.

The above studies, however, show that at least such highly developed forms as those usually referred to *Diplodia* may occur in such widely separated genera as *Tryblidiella*, *Physalospora* and

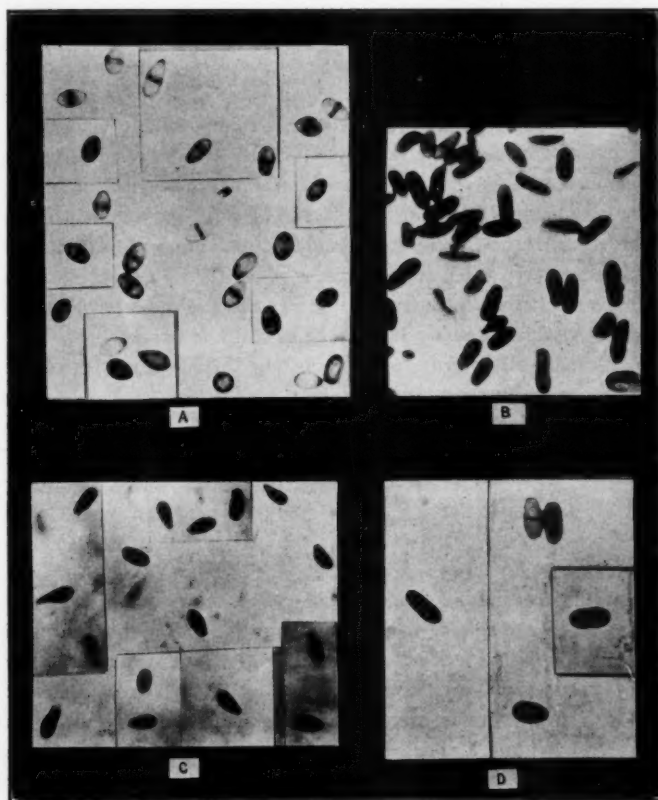


FIG. 5. (A), pycnospores (*Diplodia*) from single ascospore culture of *T. rufula?* from *Rhus*; (B), pycnospores (*Diplodia*) from single ascospore culture of *T. Leprieuri*, from tea; (C), pycnospores (*Diplodia*) from single ascospore culture of *T. rufula?* from Black Cherry; (D), pycnospores (*Diplodia*) of single ascospore culture of *T. hysterina*, from *Ilex*. All $\times 283$.

Cucurbitaria, and that parallelism of this sort evidently occurs in other cases.

No general conclusions can be drawn from the facts at present

available. Each genus and species behaves according to its own peculiar nature and what its life history may be cannot be predicted with assurance from our knowledge of what appear to be closely related genera and species. For example, one species of *Mycosphaerella* may be connected with *Phoma* or *Phyllosticta*, another with *Ramularia*, the next with *Cercospora* and then come species with *Septoria* and *Cylindrosporium*. Are there other species with still different deuteroforms?

Our present knowledge of the "Nebenfructen" of the fungi is sufficient to show that no so-called natural arrangement of the groups is possible and that they should be classified for the present solely from the standpoint of practical convenience and ease of identification. When the life histories of the ascomycetes are as completely known as in the rusts, the names of most form genera may be discarded as has been done in the Uredineae.

Although full information concerning the life histories of the pleomorphic fungi apparently will not give us an easy key to their phylogeny, or taxonomy, it will certainly reveal more of the marvelous versatility of Mother Nature and the wonderful diversity and complexity of her creations.

SUMMARY

Pure cultures from single ascospores of *Tryblidiella Leprieuri* from tea give *Diplodia*-like macropycnidia. Similar cultures of *T. rufula* (Spreng.) Sacc.? from *Rhus* give micropycnidia with hyaline sub-globose spores, and *Diplodia*-like macropycnidia. Cultures from similar material referred to the same species on black cherry gave similar micro- and *Diplodia*-like macropycnidia which are different from the preceding. Similar cultures from specimens on *Melia* from Alabama produce micro- and macropycnidia agreeing with those from the specimens on black cherry. Single ascospore cultures of *T. hysterina* (Duf.) Shear from *Ilex vomitoria* from two localities gave micropycnidia and *Diplodia*-like macropycnidia resembling *Diplodia Alni*.

The *Diplodia*-like forms obtained appear similar to those obtained from ascospore cultures from *Physalospora* and raises the question as to what dependence can be placed upon the pycnidial

or conidial stages in determining the limits of genera and species of Ascomycetes.

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THE GENERA OF HYDNACEAE

L. W. MILLER

The family Hydnaceae, as ordinarily defined, is held to include all autobasidiomycetes in which the hymenium is borne upon downward directed spines, warts or folds. As thus defined most of the genera and species are clearly separated from those of related families. Intermediate forms do occur, however, grading into the Polyporaceae on the one hand and the Thelephoraceae on the other. This fact has influenced various attempts to make the boundaries of the family more distinct. Since the time of Fries, our knowledge of the internal structure and reproduction of these fungi has been greatly increased and it has been necessary to make many changes in taxonomic treatment. The lack of agreement in current literature as to what constitutes the most precise or convenient classification is due largely to our still meager knowledge of the natural relationships among these fungi. The family has been insufficiently studied and, therefore, any scheme of classification applied to it must be regarded as tentative.

The removal of certain genera and species apparently related to the Polyporaceae but included in the Hydnaceae of Fries and his predecessors was suggested first in 1821 by the work of S. F. Gray.¹ He erected the Sistotremideae on *Sistotrema*, *Cerrena* and *Xylodon*, and characterized the new family as "thallus leather-like; hymenium at first meandering, porous, becoming toothed; teeth lamellar, torn." In 1879 Karsten transferred *Irpex*, *Sistotrema* and *Phlebia* to the Polyporaceae. Patouillard in 1900 included *Phlebia*, *Hydnochaete*, *Lopharia*, *Sistotrema* and species of *Irpex* among the polypores. Weir and Hubert (1918) comment on the daedaloid character of the young sporophore of *Echinodontium*.

¹ It is not known whether S. F. Gray, A Natural Arrangement of British Plants, Vol. 1. 1821, was published before or after Fries, Systema Mycologicum, Vol. 1. 1821. I have been informed by Dr. J. H. Barnhart that it is generally regarded as post-Friesian. This position is taken by A. B. Seymour as stated on page 9 of the preface to his Host Index of the Fungi of North America. 1929.

The toothed configuration of the hymenium in *Hydnochaete*, *Sistotrema*, *Irpex* and *Echinodontium* is typically preceded by a more or less poroid configuration. This is made evident by comparing the young, growing marginal portion of a fructification with the older central portion. The flattened and irregular teeth of the older parts of a fructification are often connected by ridges which may be regarded as the remains of the pores from which the teeth were derived. The development of teeth by the breaking up of the pores is not uncommon in other genera of the Polyporaceae. It occurs in many species of *Daedalea*, *Poria*, *Polyporus* and *Polystictus*. It would seem therefore that *Hydnochaete*, *Sistotrema*, *Irpex* and *Echinodontium* should be placed in the Polyporaceae.

Phlebia and *Lopharia* are more closely related to *Merulius* than to any genus of the Hydnaceae; they differ from *Merulius* chiefly in having the hymenial folds or ridges less anastomosed. *Phlebia* also shows close relationship to *Corticium* and thus offers a possible connecting link between the Thelephoraceae and the Polyporaceae through *Corticium* and *Merulius*. The disposition of this genus in the Merulieae of the Polyporaceae seems to be in accord with its natural relationship.

The Phylacteriaceae, erected by Patouillard in 1900 on *Caldesiella*, *Sarcodon* (i.e. *Hydnum*, as here defined) and *Calodon* of the Hydnaceae and *Phylacteria* and *Tomentella* of the Thelephoraceae, and characterized by its dark trama and dark, roughened spores, is recognized by such recent European writers as Bourdot and Galzin (1927) and Cejp (1928). Research has not yet shown that the hymenial configuration stressed by earlier mycologists should be subordinated to the characters upon which the Phylacteriaceae is segregated. Such hyphae and spore characters in the basidiomycetes have generally been regarded as of generic significance only.

The group of resupinate hydnums has been least satisfactorily divided. *Odontia* was restricted by Fries in 1838 to those species chiefly characterized by crested or penicillate warts. Today the presence of cystidia is emphasized, which is a better and more exact interpretation of the character which Fries observed. *Grandinia* Fries is generally applied to the forms which have a

granulose hymenium, as was probably originally intended by Fries. In order that *Grandinia* may be separated clearly from *Odontia* it must be restricted to species lacking cystidia. Although *Grandinia* Fries and *Odontia* Fries do not seem to be natural genera their use is justified because of their wide recognition and because of the fairly well defined and convenient division of resupinates which each represents.

In addition to *Odontia*, *Grandinia* and several other well marked resupinate genera there still remains a number of species which have fairly conspicuous spines, no cystidia and a texture varying from floccose to ceraceous. These forms are obviously included in the older genus *Odontia* of Persoon or *Hydnum* tribe *Resupinatus* of Fries. Quélet (1878) raised this group to generic ranking and applied to it the name *Hydnum*. The rules of nomenclature do not permit such a use of *Hydnum*, however. *Acia* Karsten was erected on approximately the same group but the name must be rejected as a homonym, having been applied to a genus of the Rosaceae in 1791. Recent authors either have regarded these species as a subdivision of the genus *Hydnum* or have attempted to distribute them among other recognized genera. The nearest approach to their recognition as a genus is found in *Acia* of Rea, Bourdot and Galzin and other European writers. However, these restrict *Acia* to adnate, ceraceous forms only. In order that the division of the resupinate species into genera may be complete, I am proposing the name *Oxydontia* to represent this group, defining it so as to include both adnate and separable forms which may vary in texture from floccose to ceraceous.

The principal criteria upon which the Friesian system of classifying the hymenomycetes is based, seem yet to be the most natural and workable. Many changes have necessarily been made, as is to be expected. Such a genus as *Tremellodon* would obviously be removed and placed in the Tremellales upon the discovery of cruciately divided basidia. On equally valid grounds I believe the removal of *Sistotrema*, *Irpex*, *Hydnochaete*, *Echinodontium*, *Phlebia* and *Lopharia* is justified. Our present knowledge of the Hydnaceae seems to warrant the recognition of the following genera:—*Caldesiella*, *Asterodon*, *Grandinia*, *Odontia*,

Oxydontia, *Radulum*, *Mucronella*, *Gloiodon*, *Steccherinum*, *Auriscalpium*, *Hericium*, *Dentinum*, *Hydnodon*, *Hydnum*, *Calodon* and probably *Grammothele*.

The Hydnceae in this somewhat restricted sense includes only those autobasidiomycetes in which the hymenium is borne upon downward directed spines, teeth or warts, which have not arisen by the breaking up of pores.

KEY TO THE GENERA OF THE HYDNACEAE

1. Fructification with a porose-reticulate hymenial surface covered over with minute warts. *Grammothele*.
1. Fructification with distinct warts or teeth, never poroid. (2)
 2. Trama dark; spores roughened, subhyaline to dark, usually brown. (3)
 2. Trama pale; spores smooth or sometimes echinulate, hyaline, sometimes slightly colored. (5)
3. Resupinate, soft, floccose; growing on wood. *Caldesiella*.
3. Stipitate; fleshy or coriaceous; growing on the ground. (4)
 4. Fleshy. *Hydnum*.
 4. Fibrous, tough. *Calodon*.
5. Teeth arising directly from the substratum. *Mucronella*.
5. Teeth developed on a distinct hymenophore. (6)
 6. Resupinate or reflexed; spines borne on tough, branching processes which are partially submerged in a brownish tomentum. *Gloiodon*.
 6. Resupinate, reflexed or stipitate; teeth or spines not borne on tough, branching processes. (7)
7. Fructification resupinate, thin, floccose, crustaceous, ceraceous, or subcoriaceous. (8)
7. Reflexed to stipitate, rarely resupinate; fleshy to coriaceous. (12)
 8. Ceraceous; teeth thick or occasionally slender, obtuse, usually deformed and irregularly scattered. *Radulum*.
 8. Texture variable; teeth hemispherical to cylindrical or subulate, varying from short, fragile, inconspicuous warts to long, conspicuous teeth or spines. (9)
9. Cystidia or setae present. (10)
9. Cystidia or setae absent. (11)
 10. Trama dark, floccose; spores smooth; stellate setae present. *Asterodon*.
 10. Trama pale, texture variable; spores smooth or occasionally echinulate; cystidia present. *Odontia*.
11. Warts short, hemispherical, cylindrical, or subulate and fragile. *Grandinia*.
11. Teeth or spines conspicuous, long, slender, usually terete. *Oxydontia*.
12. Fleshy; growing on the ground. (13)
12. Fleshy or coriaceous; growing on a woody substratum. (14)
13. Mesopodous; spores smooth. *Dentinum*.

13. Pileus irregular, with deformed stipe; spores minutely echinulate. *Hydnodon.*
14. Fructification richly branched or pulvinate, soft, fleshy; gloeocystidia usually present; spores spherical or subspherical. *Hericum.*
14. Fructification reflexed to laterally stipitate, rarely resupinate; subfleshy and fibrous or coriaceous; spores variable. (15)
15. Cap coriaceous, with a long, laterally attached stipe; spores slightly roughened. *Auriscalpium.*
15. Reflexed to obscurely laterally stipitate (occasionally resupinate in *S. ochraceum* and *S. laticolor*), subfleshy to coriaceous; spores smooth. *Steccherinum.*

GRAMMOTHELE Berk. & Curt. Jour. Linn. Soc. 10: 327. 1869.

Includes *Gloiothele* Bres. Ann. Myc. 18: 44. 1920.

Fructification resupinate, effused, crustaceous; hymenial surface porose-reticulate, minutely warted throughout; with or without gloeocystidia. Growing on wood in the tropics.

Grammothele is chiefly characterized by its porose-reticulate hymenial surface which is more or less completely covered over by minute warts. Since the hymenium extends over the warts the genus has been regarded as belonging to the Hydnaceae rather than the Polyporaceae. *Gloiothele* Bres. was erected on *Poria lamellosa* P. Henn. and differs from *Grammothele*, according to Bresadola, only in the possession of gloeocystidia. *Grammothele lineata* Berk. and Curt. is the type of *Grammothele*.

CALDESIELLA Sacc., Michelia 1: 7. 1877. *Odontia* Pat. Hymén. Europ. 149. 1887. *Acia* subgen. *Aciella* Karsten, Finl. Basid. 362. 1889. *Amaurodon* Schroeter, Krypt.-Fl. Schles. 3: 461. 1889. *Phaeodon* sect. *Hydnopsis* Schroeter, Krypt.-Fl. Schles. 3: 458. 1889.

Fructification resupinate, soft, floccose, dark; spines soft, conical; cystidia none; spores colored, spherical or subspherical, roughened. Growing on wood.

This genus seems closely related to *Hypochnus* of the Thelephoraceae from which it is distinguished by the presence of distinct spines. It may readily be separated from *Asterodon* and *Hydnochaete* by its roughened spores and lack of setae. The mycelial and spore characters suggest more or less close relationship with the two stipitate genera, *Hydnum* and *Calodon*. These

three genera were combined in the single genus *Phaeodon* by Schroeter in 1889. The dark mycelium and dark roughened spores were considered sufficiently distinct by Patouillard in 1900 to justify removing *Caldesiella*, *Sarcodon* (*Hydnum*) and *Calodon* from the Hydnaceae and placing them with *Phylacteria* and *Tomentella* of the Thelephoraceae in the new family Phylacteriaceae.

Caldesiella was erected in 1877 on the single species *C. italica* Sacc. and placed in the gasteromycetes. In 1881 Saccardo transferred *Hydnum ferruginosum* Fries to *Caldesiella* and correctly listed it with the hymenomycetes. Unfortunately *C. italica* grades into *Hypochnus* and is therefore not as typical a hydnum as is *C. ferruginosus* (Fries) Sacc., nor is it as common. According to our interpretation of the rules *C. italica*, however, must be regarded as the type.

ASTERODON Pat. Bull. Soc. Myc. Fr. 10: 129. 1894. *Hydnochaete* Peck, Ann. Rep. N. Y. State Mus. 50: 113. 1897, non Bres. *Hydnochaetella* Sacc. Tab. Com. Gen. Fung. 11. 1898.

Resupinate, effused, floccose-tomentose, dry; spines subulate; setae dark, simple or stellate; spores subhyaline, smooth. Growing on wood.

Asterodon resembles *Caldesiella* in the colored, floccose, resupinate fructification but may readily be distinguished by the presence of setae and the smooth, subhyaline spores. It differs from *Hydnochaete* in having stellate setae and in its dryer and more floccose texture. It corresponds to *Asterostroma* of the Thelephoraceae. *A. ferruginosum* Pat. is the type.

GRANDINIA Fries, Epicr. 527. 1838.

Fructification resupinate, thin, membranaceous, soft crustaceous or ceraceous; warts or spines small, generally fragile, hemispherical to cylindrical or subulate; cystidia or cystidia-like structures lacking; spores hyaline, smooth or roughened. Growing on wood.

The distinction between *Grandinia* and related resupinate forms is not always sharp. In fact, the genus is discarded by Quélet (Fl. Myc. Fr. 432. 1888) on the ground that it is not an

autonomous group but merely represents young stages of *Odontia* or forms of *Corticium*. Killermann (Eng. and Pr. 160. 1928.) considers it a poor genus for the same reason. *Grandinia* does not differ essentially from *Odontia* in texture and often not in the nature and character of the spines. Its species usually are more fragile and possess shorter spines, characters which, however, are not diagnostic. The spines of *Grandinia raduloides* (Karsten) Bourdot & Galzin, for example, are larger than those of *Odontia hydroides* (Cooke & Mass.) V. Hohn. In such cases the presence or absence of cystidia alone determines the generic reference. The hymenium is generally borne over the entire surface of the hemispherical warts and the cylindrical spines with obtuse apices but is often interrupted by the sterile hyphae at the apices of subulate spines. Species in which these sterile hyphae project prominently either singly or in bundles are referred to *Odontia*. *Grandinia* differs from *Corticium* in the possession of spines or warts but this distinction is not always sharp. A young fructification of a species of *Grandinia* may occasionally be quite smooth or *Corticium*-like, or a species of *Corticium* may possess a colliculose or slightly granular hymenial surface suggesting true warts.

Grandinia was erected on seven species, of which the first mentioned by Fries, *G. polycocca* Fries, is designated the type by Banker (1902). Clements and Shear (1931) cite *G. granulosa* Fries as the type.

ODONTIA Pers. *emend.* Fries, Epicr. 528. 1838. Includes *Kneiffia* Fries, Epicr. 529. 1838. (*Kneiffiella* Underwood, Bull. Torrey Club. 24: 205. 1897. *Neokneiffia* Sacc. Tab. Com. Gen. Fung. 11. 1898. *Pycnodon* Underwood, Bull. Torrey Club 25: 431. 1898.) *Dacryobolus* Fries, Summa Veg. Scand. 404. 1849. *Odontina* Pat. Hymén. Europ. 147. 1887. *Grandiniella* Karsten, Hedwigia 34: 8. 1895. *Ethei-rodon* Banker, Bull. Torrey Club 29: 441. 1902. *Hydnopsis* Rea, Brit. Basid. 650. 1922.

Resupinate, membranaceous, floccose, crustaceous or rarely ceraceous, sometimes pruinose; spines variable, conical to subulate or cylindrical, typically divided or penicillate; cystidia always present; spores variable. Growing on wood.

The presence of cystidia is diagnostic for this genus. These structures may occur scattered in the hymenium or be restricted to the apex of the spine where they project singly or in loose to compact bundles. Forms in which the projecting fascicles of cystidia may be little more than unspecialized hyphal ends, as in *Odontia Pruni* Lasch. and *Odontia cristulata* Fries, represent a transition to the condition in certain species of *Grandinia*, for example, *G. farinacea* Fries, in which the spines are terminated by sterile but non-projecting hyphae. *Odontia* is separated from *Oxydontia* and *Grandinia* by the presence of cystidia and from *Peniophora* of the Thelephoraceae by the warty configuration of the hymenium. Resupinate specimens of *Steccherinum ochraceum* and *S. lacticolor* may sometimes wrongly be referred to *Odontia*.

Odontia was established by Persoon in 1794 on two resupinate species. Later in 1801 and 1825, he reduced this genus to the rank of a subgenus of *Hydnum* and apparently included all the resupinate hydroid species known to him. Persoon's division *Odontia* of *Hydnum* in this sense was synonymous with the tribe *Resupinatus* of the same genus as treated by Fries in the *Systema Mycologicum*. S. F. Gray (1821) was the first post-Friesian writer again to recognize *Odontia* Pers. as a distinct genus. A number of attempts have been made to divide this rather large group of resupinate species into smaller and more natural or convenient genera. In 1838 Fries erected *Grandinia* and *Odontia* on certain of these species, the remaining species were retained in the tribe *Resupinatus* of *Hydnum*. The multifid or penicillate character of the crests of the spines noted by Fries in the original description of *Odontia* is apparently due largely to the projecting cystidia. Cystidia therefore have become the distinguishing character of the genus in the modern sense rather than the multifid or penicillate character in gross appearance. Many species have since been transferred to *Odontia* Fries even though the cystidia are inconspicuous and visible only under the microscope. *Odontia* Fries in this sense corresponds to *Peniophora* of the Thelephoraceae. *Odontia fimbriata* Pers. is to be regarded as the type.

Kneiffia was also established by Fries in 1838 as a new genus of the Hydnaceae, based on *Thelephora setigera* Fries. It seems that conspicuous cystidia again serve as the diagnostic character.

The two genera were not adequately distinguished in the original descriptions nor do the characters of the species included seem to justify such a separation. I am, therefore, following Patouillard (1900) in relegating *Kneiffia* to synonymy. *K. setigera* Fries is known in Europe as *Peniophora setigera* (Fries) Bres. Its reference to *Peniophora* does not seem to be justified in view of the fact that the hymenial surface usually appears papillate.

Oxydontia gen. nov. (ὄξύς, sharp; ὀδὸν, a tooth.) *Hydnum* Quélet, in Cooke & Quélet, Clav. Hymen. 200. 1878.
Acia Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 28. 1879.

Fructification resupinate, effused, adnate or separable, floccose, fleshy or ceraceous; spines typically long, subulate; cystidia absent; spores variable. Growing on wood.

Pileus resupinatus, effusus, adnatus vel secedens, floccosus, carnosus vel ceraceus, aculeis longis, subulatis, cystidiis nullis. Hab. ad ligna.

Type: *Hydnum setosum* Pers.

Oxydontia is separated from *Odontia* by its lack of cystidia and from *Grandinia* by the longer, subulate and conspicuous teeth. These distinctions are admittedly artificial but have the advantage of being convenient and fairly distinct. Since all gradations occur between sterile basidia and typical cystidia certain species will obviously need to be placed arbitrarily in *Odontia* or in *Oxydontia*. The same is true of species possessing teeth intermediate between the typical dome-shaped or fragile warts of *Grandinia* and the elongated, subulate teeth of *Oxydontia*.

Species collected in Iowa which I include in this genus are *O. himantia* (Schw.), *O. alboviride* (Morg.), *O. fragilissima* (Berk. & Curt.), *O. stenodon* (Pers.), *O. setosa* (Pers.), *O. macrodon* (Fries). *Oxydontia* is essentially synonymous with *Hydnum* Quélet (1878) and *Acia* Karsten (1881) but neither name is tenable. *Hydnum* is applied to a group of stipitate forms and *Acia* was applied to a genus of the Rosaceae by Schreber in 1791. *Oxydontia* includes a greater range of species than the *Acia* of Rea and Bourdot and Galzin. Forms that have floccose or fleshy as well as separable fructifications are added. For example, *O. fragilissima* (Berk & Curt). is ceraceous and a good "*Acia*" except that it is separable; *O. himantia* (Schw.)

or *O. alboviride* (Morg.) may have waxy, *Acia*-like teeth but a floccose subiculum.

RADULUM Fries, Elenchus Fung. 1: 148. 1828. *Phaeoradulum* Pat. Tax. Hymén. 69. 1900. *Tylodon* Banker, Bull. Torrey Club 29: 440. 1902.

Fructification resupinate, rarely reflexed, fleshy-ceraceous; teeth blunt, generally coarse, deformed, irregularly scattered or confluent. Growing on wood.

The species of *Radulum* are exceedingly variable in the expression of external characters. Microscopic structures must be noted. The spore characters prove helpful for the few species which have been found in Iowa. Members of this genus show some relationship with certain of the fleshy or waxy species of *Corticium* which exhibit at times a colliculose hymenium or widely and irregularly scattered humps, for example, *C. tuberculatum* Karsten, *C. cremicolor* Berk. & Curt. and *C. hydnans* (Schw.) Burt. The exact dividing line between *Radulum* and *Corticium* is, therefore, not always sharp. I believe it best to refer to *Corticium* those forms in which humps sometimes occur irregularly or appear merely as slightly raised areas on the hymenial surface.

Banker (1902) designates the species represented by *Radulum pendulum* Fries in the Elenchus Fungorum as the type of this genus. This species is regarded as a form of *Corticium subcostatum* (Karst.) by Bourdot and Galzin. Clements and Shear (1931) cite *Radulum orbiculare* Fries as the type. The latter species is widely distributed and a typical representative of the genus.

MUCRONELLA Fries, Hym. Europ. 629. 1874. *Mucronia* Fries, Summa Veg. Scand. 329. 1849.

Subiculum absent or consisting of a floccose, fugacious mycelium; spines subulate, entire. Growing on wood and bark.

This genus is quite distinct. It resembles a small *Clavaria* or *Pterula* in general appearance but differs fundamentally in its pendent spines. It is best considered a resupinate hydnum in which the subiculum has almost or quite disappeared. The type species is *Hydnum calvum* A. & S. The name *Mucronia* is

untenable, having been applied to a genus of the Polygonaceae in 1837.

GLOIODON Karsten *emend.* Banker, Mycologia 2: 10. 1910.
Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 28. 1879, in part.
Sclerodon Karsten, Finl. Basid. 360. 1889. *Leaia* Banker,
Mem. Torrey Club 12: 175. 1906.

Fructification resupinate to pileate and laterally sessile, tough, fibrous, dark, consisting of branched processes in a coarse tomentum; teeth slender, acute; spores faintly roughened, short elliptical, hyaline. Growing on wood.

The branched processes in the pileus constitute the outstanding character of the genus and readily separate it from other genera of the Hydnaceae. Its texture, color and spore characters suggest relationship with *Auriscalpium* from which it is sharply marked off, however, by the branching processes and the resupinate or sessile fructification.

Karsten based *Gloiodon* on *Hydnum strigosum* Schw. and two other species. Banker seems first to have emphasized the branching processes in the fructification of the type as a diagnostic generic character. Patouillard, Bresadola, Rea and others who do not recognize *Gloiodon* associate its species generally with those of *Steccherinum* as treated in this paper. The slightly colored hyphae, the roughened spores and the dividing processes contrast sharply, however, with the equivalent characters of species of *Steccherinum*.

STECCHERINUM S. F. Gray, Nat. Arr. Brit. Pl. 1: 651. 1821.
Pleurodon Quélet, in Cooke and Quélet, Clav. Hymen. 198.
1878, in part. *Creolophus* Karsten, Medd. Soc. Faun. Fl.
Fenn. 5: 27. 1879. *Climacodon* Karsten, Rev. Myc. 3: 20.
1881. *Leptodon* Quélet, Ench. Fung. 191. 1886, *emend.*
Pat. Hymén. Europe. 146. 1887. *Mycoleptodon* Pat.
Tax. Hymén. 116. 1900.

Pileus laterally substipitate or sessile, reflexed or rarely entirely resupinate, usually tough and fibrous, sometimes subfleshy; spines terete or flattened; cystidia common; spores minute, smooth, ovoid to oblong, white in mass. Growing on wood.

Steccherinum is related to *Gloiodon* and to *Auriscalpium*, but may readily be separated from the former by the hyaline hyphae,

smooth spores and the absence of the solid processes ramifying through the pileus, and from the latter by a generally lighter colored fructification and the absence of a distinct stipe.

Several attempts have been made to divide the species represented in *Steccherinum* into more homogeneous groups. Karsten proposed the name *Creolophus* apparently to include the sub-fleshy species and *Climacodon* the leathery members but the distinction was not clearly made. Banker suggested a similar division in 1913. Such a distinction between fleshy and leathery members of the genus seems inadvisable since all, including *S. pulcherrimum*, perhaps regarded as the most "fleshy," have a more or less fibrous texture. The type is *Hydnum ochraceum* Pers.

AURISCALPIUM S. F. Gray, Nat. Arr. Brit. Pl. 1: 650. 1821.

Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 27. 1879. *Pleurodon* Quélet, in Cooke and Quélet, Clav. Hymen. 198. 1878, emend. Karsten, Rev. Myc. 9: 19. 1881. *Leptodon* Quélet, Ench. Fung. 191. 1886, in part.

Pileus entire or lobed, laterally stipitate, leathery; spines slender, subulate; cystidia if present little differentiated; spores hyaline, small. Growing usually on cones of conifers.

This genus is distinguished from *Steccherinum* by the lateral stipe. Intermediate species occur, however, in which the pileus may be laterally short stipitate as in *S. adustum* and *S. reniforme*.

As treated by Quélet (1878) *Pleurodon* was equivalent to the tribes *Pleuropus* and *Apus* of the genus *Hydnum* of Fries. Later (1886 and 1888) Quélet seems to have substituted the name *Leptodon* for essentially the same group. He did not recognize the generic distinction between the forms with lateral stipes and those with resupinate, reflexed or laterally sessile pilei. In this broad sense the genus included a number of species of *Steccherinum*. In 1879 Karsten erected a new genus *Auriscalpium* on *Hydnum auriscalpium* L. and two other species, which is antedated by *Auriscalpium* S. F. Gray. Most of the remaining species which Quélet included in *Pleurodon*, Karsten distributed in two or three other new genera. In 1881 Karsten seems to have substituted Quélet's name *Pleurodon* for his own *Auriscalpium*.

The name *Pleurodon* in this restricted sense is in common usage in Europe. *A. vulgare* S. F. Gray (*Hydnum auriscalpium* L.) is the type of *Auriscalpium*.

HERICIUM Pers. ex. S. F. Gray, Nat. Arr. Brit. Pl. 1: 652. 1821.
Medusina Chev. Fl. Gen. Env. Paris. 278. 1826. *Dryodon*
 Quélet, in Cooke and Quélet, Clav. Hymen. 198. 1878.
Friesites Karsten, Medd. Soc. Faun. Fl. Fenn. 5: 27. 1879.
Manina Scop. ex. Banker, Mycologia 4: 275. 1912.

Fructification fleshy or subfleshy, nodulose, tuberculiform or branched; spines mostly subulate, long and pendent; gloeocystidia usually present; spores spherical or subspherical, guttulate. Growing on wood.

Hericium Pers. was considered by Fries in the Systema Mycologicum as synonymous with his tribe *Merisma* of the genus *Hydnum*. In 1825 Fries recognized *Hericium* as a genus but in a different and questionable sense (Banker, Mycologia 4: 275. 1912.). Regardless of Fries's treatment of *Hericium* the name may still be used since S. F. Gray in 1821 clearly defined the genus and published with it the same single species *H. coralloides* which appeared in the original description of *Hericium* by Persoon (1794).

DENTINUM S. F. Gray, Nat. Arr. Brit. Pl. 1: 397. 1821. *Tyrodon* Karsten, Rev. Myc. 3: 19. 1881. *Hydnum* L. ex Fr. Syst. Myc. 1: 397. 1821, *emend.* Pat. Hymén. Europ. 145. 1887. *Hypothele* Paulet ex Banker, Torreyia 4: 113. 1904.

Pileus with a central stipe, fleshy, white or pale; spines subulate; spores white in mass. subspherical. Growing on the ground.

Dentinum is distinguished from related genera by its pale color and its hyaline, smooth spores.

This genus is commonly known today by the name *Hydnum*. The earlier name *Dentinum* S. F. Gray is here restored in accordance with the rules of the international code. *Dentinum* was founded on *H. repandum* (type) and *H. rufescens*.

HYDNODON Banker, Mycologia 5: 297. 1913.

Pileus with a deformed stipe, irregular, expanded, fleshy, thin, drying hard and brittle, orange to red; teeth short, stout,

deformed, reddish; spores minute, echinulate, whitish or faintly colored. Growing on the ground in the tropics. North Carolina.

Hydnodon is based on *Hydnum thelephorum* Lév. which is chiefly characterized by the thin, fleshy substance, deformed stipe, short, stout and deformed teeth and the whitish, echinulate spores. The description and a specimen from Jamaica which I saw at The New York Botanical Garden suggest relationship with species of *Dentinum*.

HYDNUM L. *emend.* S. F. Gray, Nat. Arr. Brit. Pl. 1: 650. 1821.

Fries, Syst. Myc. 1: 397. 1821, in part. *Sarcodon* Quélet, in Cooke and Quélet, Clav. Hymen. 195. 1878. *emend.* Karsten, Rev. Myc. 3: 20. 1881.

Pileus with a central stipe, fleshy, generally dark colored; spines subulate, simple; spores small, subspherical, angular or echinulate, brown. Growing on the ground.

This genus is separated from *Calodon* by its fleshy texture and from *Dentinum* by its dark color and roughened spores. Fries, in the Systema Mycologicum, referred a very large and heterogeneous group, comprising all species with awl-shaped spines, to the genus *Hydnum*. As thus defined *Hydnum* included a large majority of the species of the family, ranging from the simple resupinate forms to the more specialized stipitate forms. It is obviously desirable to separate such a large and heterogeneous group into smaller and more homogeneous genera. The various attempts to do this have resulted in a comparatively large number of proposed segregates and generic names. The application of the name *Hydnum* has varied considerably.

In 1821 S. F. Gray erected a number of new genera in the Hydnaceae and retained the name *Hydnum* for certain of the fleshy, mesopodous species, of which *Hydnum imbricatum* only was mentioned. Since the fleshy mesopodous *Hydnum repandum* was transferred to his new genus *Dentinum*, it is apparent that *Hydnum* as used by Gray is identical with *Sarcodon* Quélet. Karsten in common usage today. Quélet (1878) and Karsten (1881) applied the name *Hydnum* to the large number of resupinate species which at that time had not been transferred to other recognized resupinate genera, such as *Odontia* and *Grandinia*. Patouillard (1887) was the first to restrict the name *Hydnum*,

as now commonly used, to the fleshy, mesopodous, white-spored forms growing on the ground. In 1900 Patouillard enlarged the boundaries of the genus to include also *Hericium* Pers. and *Dryodon* Quél. Banker, Bourdot and Galzin and Cejp follow Patouillard's earlier conception. Gäumann and Dodge state that *Hydnum repandum* is the type. Clements and Shear, however, indicate *H. imbricatum* as the type. *Hydnum* as used by Coker (1919) is antedated by *Sarcodon* Quél. Hennings and Killermann (old and new edition of Engler & Prantl) and Rea retain in large part the Friesian conception of the genus.

Hydnum repandum is the nomenclatorial type of *Hydnum* according to common usage. That species, however, must be referred to *Dentinum* and therefore cannot serve as the type of *Hydnum*. According to the International rules it seems that *Hydnum imbricatum* L. must be regarded as the type. In some respects it is unfortunate that this species should be regarded as the type of the type genus since neither the dark, tuberculate spores nor the dark hyphae of the fructification are as typical of the family as a whole as are the hyaline, smooth spores and pale hyphae of *Hydnum (Dentinum) repandum*, which is also usually the commoner species. Nevertheless, if the two species are to be recognized as representing distinct genera, as seems to the writer amply justified, the rules seem clearly to necessitate citing *imbricatum* as the type of the genus *Hydnum*.

CALODON Quél. in Cooke & Quélet, *Clav. Hymen.* 196. 1878.
Hydnellum Karsten, *Medd. Soc. Faun. Fl. Fenn.* 5: 27.
1879. *Phellodon* Karsten, *Medd. Soc. Faun. Fl. Fenn.* 6:
15. 1881.

Pileus with a central stipe, fibrous, tough, sometimes woody, dark colored; spores subspherical, coarsely angular or echinulate, brown or subhyaline. Growing on the ground.

Calodon differs from both *Hydnum* and *Dentinum* by its tough, fibrous texture. Karsten in 1881 divided this genus into the white toothed forms to which he gave the name *Phellodon* and the dark toothed forms to which he assigned Quélet's name *Calodon* rather than his own name *Hydnellum*. This distinction was maintained by Banker and tentatively by Coker; both, however, applied the name *Hydnellum* to the group with dark spines.

Banker (1906) described the spores of *Hydnellum* as "colored, coarsely tuberculate," and the spores of *Phellodon* as "white or hyaline, usually echinulate." I have examined a number of species belonging to each of these proposed genera and feel that the differences are not sufficiently distinct. There seems to be a gradual transition from the darker forms with coarse tuberculate spores to the less dark with echinulate, pale spores. *Hydnellum* and *Phellodon* do not seem to me to be two distinct groups with a few intermediate forms but rather a single group which varies somewhat in color and in the roughened character of the spore. *Hydnum suaveolens* Scop. is regarded as the type.

The present study was pursued in the mycological laboratories of the State University of Iowa under the direction of Prof. G. W. Martin.

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NEW GENERA AND SPECIES OF LICHENS FROM THE HERBARIUM OF BRUCE FINK I¹

JOYCE HEDRICK

The specimens upon which these genera and species are based were collected within the United States. Most of the specimens were collected by Dr. Bruce Fink or were sent to him for identification by other collectors. In a few cases the specimens, named but apparently undescribed, have come from the herbaria of earlier investigators. Wherever possible the names have been attributed to the original investigators, but the descriptions were prepared by Dr. Fink. All of the specimens were studied by him in the preparation of the manuscript for "The Lichen Flora of the United States" which has not yet been published.

Since there is no certainty when his manuscript will be published, it seems best that these descriptions should appear in a separate paper so that they may be available to other students of the group. They have been copied from his manuscript with very little change. The accompanying notes have been made from his notations on the specimen packet or herbarium sheet.

The type specimens were deposited in the Fink Herbarium which is now a part of the Herbarium of the University of Michigan. The writer wishes to thank Professor E. B. Mains for helpful suggestions and criticism in preparing the manuscript, and Professor H. H. Bartlett and Miss M. E. Anthony for correcting the Latin descriptions.

1. *Verrucaria nigrescentoidea* Fink, sp. nov.

Thallus tenuissimus vel tenuis, late expansus, levis vel leviter confragosus, demum areolatus, glauco-fuscus vel obscure niger; perithecia minuta vel parva, 0.1-0.3 mm. lata, dimidiata, numerosa, plus minusve immersa, subhemisphaerica, obscure nigra; sporae 8, decolores, ellipsoideae, non septatae, $12-15 \times 5-6 \mu$, inconditae.

Thallus very thin to thin, widespread, smooth to slightly rough, becoming areolate, grayish-brown to dull black; perithecia minute

¹ Papers from the Department of Botany and the Herbarium of the University of Michigan, No. 412.

to small, 0.1–0.3 mm. across, dimidiate, numerous, more or less immersed, the superficial portion subhemispherical, dull black; hypothecium and hymenium hyaline; paraphyses gelatinizing and disappearing; asci clavate; spores 8, hyaline, ellipsoid, non-septate, $12\text{--}15 \times 5\text{--}6 \mu$, irregularly arranged.

The algal host is *Pleurococcus*.

On rock, Auburndale, Minnesota, collected by Bruce Fink September 8, 1902 (type), Fink Herb. No. 15,532.

Very similar to *V. nigrescens* Pers., but with smaller spores. *V. nigrescens* has spores which are $15\text{--}28 \times 7\text{--}11 \mu$, so that these are less both in length and width.

2. *Verrucaria subsuperficialis* Fink, sp. nov.

Thallus tenuis vel sat crassus, levis vel leviter confragosus, olivaceus, e parvis areolis insularibus dispersis in hypothallo diffuso constans; perithecia minuta, 0.17–0.2 mm. lata, olivaceo-nigra, dispersa vel contigua, superne sphaeroidea vel subconoidea, inferne plana, haud vel partim in thallo immersa, integra aut dimidiata; sporae 8, decolores, ovoideo-oblongae, non septatae, $7\text{--}9 \times 4\text{--}5 \mu$.

Thallus thin to somewhat thick, smooth to slightly rough, olivaceous, occurring fully developed with perithecia in small areas, these areas interspersed in about equally extensive very thin areas (hypothallus) showing the lichen hyphae and the algal host cells, both the thick and the thin areas remaining firm when wet; perithecia minute, 0.17–0.2 mm. across, olivaceous-black, sphaeroidal or subconical above and flattened below, scattered to closely placed, entirely above the substratum and readily removed with the thallus, the basal third immersed in the latter, complete with perithecial wall thin below, or sometimes dimidiate and centrally open below; hypothecium and hymenium hyaline; paraphyses gelatinizing early and invisible at maturity of spores; asci clavate; spores 8, hyaline, ovoid-oblong, non-septate, $7\text{--}9 \times 4\text{--}5 \mu$.

The algal host is *Pleurococcus*, but the thecial algae are apparently *Trentepohlia*.

On a littoral quartz pebble, Long Beach Bay, Orient, Long Island, New York, collected by Roy Latham in 1925 (type).

Species of *Verrucaria* of marine and brackish habitat are few and always interesting; and other lichens of similar habitats are likewise not numerous. Similar to *V. margacea* Wahl. and *V. aethiobola* Wahl. as to thallus but the thick and thin areas are more pronounced here. Distinguished from the two above and

from most of the other species of *Verrucaria* of the United States by the small spores which are not more than $10\ \mu$ in length.

3. *Verrucaria silicola* Fink, sp. nov.

Thallus tenuis vel mediocriter crassus, levis vel confragosus, demum rimosus, interdum minute granulosis, obscure glaucus vel niger; perithecia minuta vel parva, 0.15–0.4 mm. lata, dispersa aut plus minusve aggregata, immersa vel partim superficialia, dimidiata, supra subhemisphaerica aut subconoidea, obscure nigra, ostiolo minuto, saepe vix conspicuo; sporae 8, decolores, oblongo-ellipsoideae, non septatae, $18\text{--}22 \times 8\text{--}9\ \mu$, inconditae.

Thallus thin to moderately thick, smooth to rough, becoming chunky, sometimes appearing minutely granulate, dark greenish-gray to black; perithecia minute to small, 0.15–0.4 mm. across, scattered or more or less clustered, immersed to partly superficial, the wall dimidiate and centrally open below, the superficial portion subhemispherical or subconical, dull black, the ostiole minute, often scarcely visible; hypothecium and hymenium hyaline; paraphyses gelatinizing early, becoming indistinct and disappearing; asci clavate, inflated; spores 8, hyaline, oblong-ellipsoid, non-septate, $18\text{--}22 \times 8\text{--}9\ \mu$, irregularly arranged.

The algal host is *Pleurococcus*.

On a littoral quartz pebble, Orient, Long Island, New York, collected by Roy Latham (type) and from East Hampton, Long Island, collected by the same, April 20, 1926.

Thallus somewhat similar to *V. nigrescens* Pers. and *V. viridula* (Schr.) Ach., but distinguished by the granulate rather than areolate appearance of these two. Separated from the other maritime species found in the United States by the larger spores reaching $22\ \mu$ in length.

Thelidiella Fink, gen. nov.

A *Thelidium* Mass. thallo parasitico et inconspicuo, in hospitis thallo immerso differens.

4. *Thelidiella blastenicola* Fink, sp. nov.

Thallus parasiticus et inconspicuus, in hospitis thallo immersus; perithecia minutissima, 0.06–0.09 mm. lata, dimidiata et partim immersa, nigra, solitaria vel compluria in squamis aut apotheciis hospitis, supra hemisphaerica vel obscure subconoidea, ostiolo rarissime conspicuo; hypothecium et hymenium decolora; paraphyses gelatinose confluentes et mox evanescentes; asci late clavati, superne membrana incrassata cincti; sporae 8, decolores, ellipsoideo-dactyloideae, 1-septatae, demum ad septum leviter constrictae, loculo apicali majore, $9\text{--}11 \times 3\text{--}4\ \mu$, inconditae.

Thallus immersed in that of the lichen host and invisible; perithecia very minute, 0.06–0.09 mm. across, dimidiate and

partly immersed, black, seated 1—several on single squamules or apothecia of the host, the superficial portion hemispherical to obscurely subconical, the ostiole only very rarely and tardily visible; hypothecium and hymenium hyaline; paraphyses gelatinizing and disappearing early; asci broadly clavate, the wall not much thickened in the apical region; spores 8, hyaline, ellipsoid-dactyloid, 1-septate, the upper cell larger, becoming slightly constricted at the septum, $9-11 \times 3-4 \mu$, irregularly arranged.

The algal host is *Protococcus*.

On the thallus and apothecia of *Blastenia neomexicana* Fink, near Las Vegas, New Mexico, collected by Brother Anect, November 12, 1925 (type), Fink Herb. No. 15,528.

A genus similar to *Thelidium* Mass., but separated because of its habit of growth,—that is, it is found growing on another lichen. It may be questioned whether or not such plants are lichens but it is supposed that the hyphae come in contact with and derive some benefit from the algal cells within the lichen host. For this reason this new genus can be placed with the lichens.

5. *Dermatocarpon moulinsii subpapillosum* Fink, var. nov.

Subtus minute papillatus.

The lower surface minutely papillose, separating it from the species.

On sandstone ledge in Idaho, collected by Heller in 1896 (type), Fink Herb. No. 12,825, and from Waldron Island, Washington, July 10, 1906, Fink Coll. No. 276, Fink Herb. No. 5517.

6. *Arthopyrenia dimidiata* Fink, sp. nov.

Thallus tenuissimus vel tenuis, levis vel leviter confragosus, continuus vel rimosus et interdum areolatus, glaucus vel cinereus; perithecia minuta, 0.1–0.25 mm. lata, supra subhemisphaerica, obscure nigra, dimidiata; sporae demum 8, decolores, ellipsoideae, 1-vel rare 2-septatae, loculo apicali majore, $10-14 \times 5-6 \mu$, inconditae.

Thallus very thin to thin, smooth to somewhat rough, continuous to chinky and sometimes areolate, grayish to ashy; perithecia minute, 0.1–0.25 mm. across, the superficial portion subhemispherical, dull black, the wall dimidiate; hypothecium and hymenium hyaline; paraphyses interwoven and branched, remaining distinct (very plainly branched); asci broadly clavate, the wall little thickened in the apical region; spores reaching 8, hyaline, ellipsoid, 1- to rarely 2-septate, the upper cell larger, $10-14 \times 5-6 \mu$, irregularly arranged.

The algal host is *Trentepohlia*.

On schistose granite near Ellsworth, Connecticut, collected by H. A. Green in 1895 (type), Fink Herb. No. 15,469.

Very similar to *A. distans* (Willey) Zahlbr., but that has spores $14-21 \times 5-7 \mu$. This specimen was labelled *Verrucaria distans* Willey, a species listed by Zahlbruckner under *Arthopyrenia distans* (Willey) Zahlbr. Cat. Lich. Univ. 1: 276, and also under *Thelidium distans* (Willey) Zahlbr. Cat. Lich. Univ. 1: 119. The distinct paraphyses of this specimen rule it out of *Thelidium*, and the smaller spores separate it from *A. distans*.

7. *Polyblastiopsis dealbens* Fink, sp. nov.

Thallus tenuis et glaucus, levis vel leviter confragosus, rimosus, interdum demum pulverulentus; perithecia minuta vel parva, 0.15-0.4 mm. lata, rotundata vel difformia, supra dejecta convexa, nigra aut albida pruinosa, ostiolo rare conspicuo; sporae 4-8, decolores, oblongo-ellipsoideae, 8-9-transverse septatae et 1-2-longitudinale septatae, $30-38 \times 15-16 \mu$, inconditae.

Thallus thin and ashy, smooth to slightly rough, chinky, sometimes becoming powdery; perithecia minute to small, 0.15-0.4 mm. across, round to irregular, the superficial portion depressed-convex, black or more commonly whitish pruinose, the ostiole rarely visible; hypothecium dark brown; paraphyses interwoven and branched; asci clavate; spores 4-8, hyaline, oblong-ellipsoid, 8-9-septate transversely and 1-2-septate longitudinally, $30-38 \times 15-16 \mu$, irregularly arranged.

The algal host is *Trentepohlia*.

On trees in the Lookout Mountains, Tennessee, collected by W. W. Calkins (type), Fink Herb. No. 11,573, and in South Carolina collected by H. A. Green, Fink Herb. No. 11,252. The type specimen was labelled *Pyrenula dealbens* Nyl., but apparently no description was ever published by Nylander.

Similar to *P. lactea* (Mass.) Zahlbr., but differing in the somewhat powdery appearance of the thallus, the larger perithecia, and in the superficial portion of the perithecia. In *P. lactea* the superficial portion is strongly convex and not so commonly pruinose.

8. *Polyblastiopsis floridana* Fink, sp. nov.

Thallus tenuis vel mediocriter crassus, demum confragosus et verrucosus, flavo-cinereus vel fuscus; perithecia minuta vel parva, 0.15-0.4 mm. lata, immersa verrucis, dimidiata, apice nigro et conspicuo, ostiolo interdum conspicuo; sporae 4- rare 6 vel 8, decolores, ellipsoideae, 7-9-transverse septatae et 1-2-longitudinale septatae, $50-68 \times 13-16 \mu$, inconditae.

Thallus thin to moderately thick, becoming rough and warty, yellowish-ashy, varying toward brownish; perithecia minute to small, 0.15–0.4 mm. across, imbedded in thalloid warts, the wall dimidiate, the apex visible and black, with the ostiole sometimes showing; hypothecium hyaline or rarely tinged brownish; hymenium hyaline; paraphyses interwoven and branched; asci long clavate; spores 4– rarely 6 or 8, hyaline, ellipsoid, 7–9-septate transversely and 1–2-septate longitudinally, $50\text{--}68 \times 13\text{--}16 \mu$, irregularly arranged.

The algal host is *Trentepohlia*.

On trees in Florida, collected by J. D. Smith (type), Fink Herb. No. 11,253. The specimen was labelled *Segestria floridana* Tuck. in herb., but apparently no description was ever written by Tuckerman.

Separated from the other species of this genus by the distinctly heavier thallus which becomes warty, and by the size of the spores.

9. *Porina cestrensis platyspora* Fink, var. nov.

Sporae $36\text{--}50 \times 5\text{--}9 \mu$, eis formae typicae speciei duplo latiores.

Spores $36\text{--}50 \times 5\text{--}9 \mu$, thus reaching twice the width usually found in the species.

On beech trees in a wood near Scipio, Indiana, collected by Bruce Fink, February 8, 1909 (type), Fink Herb. No. 8,889.

10. *Porina nucula heterospora* Fink, var. nov.

Sporae 5–13-septatae, majores quam eae formae typicae speciei, $65\text{--}92 \times 10\text{--}12 \mu$.

Spores larger than in the species, 5–13-septate, $65\text{--}92 \times 10\text{--}12 \mu$.

On trees in Florida, collected by W. W. Calkins (type), Fink Herb. No. 15,512.

11. *Porina olivacea microspora* Fink, var. nov.

Thallus tenuis, levis aut leviter rugosus vel rimosus, obscure olivaceo-fuscus; perithecia minuta, 0.15–0.25 mm. lata, hemisphaerica, dimidiata, nigra, ostiolo non conspicuo, leviter immerso; sporae 8, decolores, longo-ellipsoideae, 3-septatae, $15\text{--}22 \times 4\text{--}4.5 \mu$, inconditae.

Thallus superficial, thin, smooth or somewhat wrinkled or chinky, dark olive-brown; perithecia minute, 0.15–0.25 mm. across, hemispherical, the wall dimidiate, the ostiole invisible, slightly immersed, the superficial portion black; hypothecium and

hymenium hyaline; paraphyses hyaline, non septate, few and unbranched; asci clavate to cylindro-clavate; spores 8, hyaline, long-ellipsoid, 3-septate, $15-22 \times 4-4.5 \mu$, irregularly arranged.

On trees at Lonely Lake, New Hampshire, collected by W. G. Farlow (type), Fink Herb. No. 11,559, and from Chocorua, New Hampshire, Fink Herb. No. 11,558.

12. *Pyrenula Herrei* Fink, sp. nov.

Thallus tenuis, levis vel obscure scaber, cinereus vel virido-fuscus vel fuscus; perithecia minuta vel parva, $0.2-0.35$ mm. lata, partim immersa vel adnata, nigra, nitida, dimidiata, hemisphaerica vel interdum subglobosa, ostiolo rare conspicuo; sporae 8, fuscae, fusiformae vel ellipsoideae, 3-septatae, loculis lentiformibus, $16-20 \times 6-8 \mu$.

Thallus rudimentary, the superficial portion thin, smooth or obscurely scurfy, ashy or greenish brown to brown; perithecia minute to small, $0.2-0.35$ mm. across, partly immersed to adnate, black, often shiny, hemispherical or sometimes subglobose, the ostiole rarely visible, the wall dimidiate; hypothecium hyaline; hymenium brownish; paraphyses unbranched, distinct or semi-distinct; asci cylindrical or long-clavate; spores 8, brown, fusiform to ellipsoid, 3-septate, the cells lenticular, $16-20 \times 6-8 \mu$.

The algal host is *Trentepohlia*.

On trees in the Santa Cruz Peninsula, California, collected by A. W. Herre (type), Fink Herb. No. 13,044.

Somewhat similar to *P. nitida* (Weig.) Ach., but separated by the smaller perithecia with very inconspicuous ostiole and somewhat smaller spores of this specimen.

13. *Belonia americana* Fink, sp. nov.

Thallus tenuissimus vel tenuis, levis, cinereus vel albidus; perithecia parva vel mediocria, $0.3-0.8$ mm. lata, partim immersa, velo tenui et albo formi thalli intacta, apice conspicua, nigra, nonnumquam ab margine alba cincta, ostiolo minuto plerumque inconspicuo et interdum ab velo albo tecto, excipulo integro, supra crasso, infra tenue; sporae 8, decolores, longe aciculares, demum $39-44$ -septatae, $170-250 \times 2-3 \mu$, parallelae.

Thallus very thin to thin, smooth, ashy-gray to whitish; perithecia small to middle-sized, $0.3-0.8$ mm. across, partly immersed, covered by a thin, whitish thalloid veil, the apex visible, black, sometimes surrounded by a white border, the ostiole minute, usually invisible, and sometimes covered by a white layer, the wall complete, thick above and thin below; hypothecium tinged brownish; hymenium hyaline; paraphyses parallel, unbranched, coherent and indistinct; asci soon breaking down;

spores 8, hyaline, long acicular, reaching 39–44-septate, $170\text{--}250 \times 2\text{--}3 \mu$, parallelly arranged.

The algal host is *Protococcus*, instead of *Trentepohlia* as has been found for this genus.

On trees near Houston, Texas, collected by H. W. Ravenel (type), Fink Herb. No. 10,695.

The genus has not been reported previously from the United States. Zahlbruckner lists 4 species in his Cat. Lich. Univ. This is the first species recorded for the western hemisphere. It differs from *B. russula* Koerb., *B. fennica* Vainio, and *B. herculana* (Rehm) Hazsl. by the larger spores. No description of *B. terrigena* Eitner was seen.

14. *Arthonia diffusella* Fink, sp. nov.

Thallus tenuis, levis vel leviter confragosus, obscure albus vel cinereus; apothecia minuta vel parva, 0.1–0.3 mm. lata, rotundata vel difformia, solitaria aut rare frequentia, partim immersa vel adnata, disco plano vel leviter convexo, nigro; sporae 8, decolores, oblongo-ovoideae, 1–3-septatae, sed plerumque 2-septatae, uno aut duobus loculis apicalibus majoribus, $12\text{--}15 \times 3.5\text{--}4 \mu$, inconditae.

Thallus thin, smooth to slightly rough, dull white to ashy; apothecia minute to small, 0.1–0.3 mm. across, round to more frequently irregular, solitary or rarely clustered, partly immersed to adnate, the disk flat to slightly convex, black; hypothecium brownish; hymenium hyaline to tinged brownish; paraphyses interwoven and branched, often indistinct; asci subpyriform, the apical wall much thickened; spores 8, hyaline, oblong-ovoid, 1–3 but usually 2-septate, constricted at the septum with 1 or 2 upper cells commonly larger, $12\text{--}15 \times 3.5\text{--}4 \mu$, irregularly arranged.

The algal host is *Trentepohlia*.

On old wood in a swamp near Koochenchink, Minnesota, collected by Bruce Fink July 30, 1901 (type), Fink Herb. No. 15,475. Also collected by A. H. Povah on Isle Royale, Michigan, summer of 1930, Povah Coll. No. 22.

Very similar to *A. diffusa* Nyl., but the apothecia are somewhat smaller and the spores are larger, at least in length.

15. *Arthonia rupicola* Fink, sp. nov.

Thallus tenuissimus, levis, late expansus, pallide glaucus vel cinereus, demum evanescentes; apothecia minuta, 0.1–0.25 mm. lata, adnata, rotundata vel difformia, disco convexo nigro; sporae 8, decolores, oblongae, uniseptatae, ad septum constrictae, loculo apicali majore, $10\text{--}15 \times 4.5\text{--}6 \mu$, inconditae.

Thallus very thin, smooth, widespread, pale greenish-gray to ashy, finally disappearing; apothecia minute, 0.1–0.25 mm. across, adnate, round to irregular, the disk convex, black; hypothecium tinged brownish; hymenium hyaline; paraphyses indistinct, appearing interwoven and branched; asci broadly clavate to subovoid, the apical wall considerably thickened; spores 8, hyaline, oblong, 1-septate, constricted at the septum, the upper cell larger, $10-15 \times 4.5-6 \mu$, irregularly arranged.

The algal host is *Trentepohlia*.

On limestone rock near Oxford, Ohio, collected by Bruce Fink, May 11, 1927 (type).

Separated from the other species of *Arthonia* growing on rock and known from the United States by the very thin, smooth, light-colored thallus, and from *A. lapidicola* (Tayl.) Branth & Rostr. by the spores having unequal cells.

16. *Arthonia Willeyi* Tuck. sp. nov. in herb.

Thallus albidus opacus, mediocriter crassus, levis vel leviter confragosus; apothecia minuta vel parva, 0.1–0.35 mm. lata, roundata vel leviter difformia, partim immersa vel adnata, disco plano vel convexo, nigro; sporae 8, decolores, ovoideo-ellipsoideae, 1-septatae rare 2-septatae, $10-13 \times 3-4 \mu$.

Thallus dull white, of moderate thickness, smooth to slightly rough; apothecia minute to small, 0.1–0.35 mm. across, round to slightly irregular, partly immersed to adnate, the disk flat to convex, black; hypothecium and hymenium tinged pale yellowish; paraphyses indistinct; asci pyriform; spores 8, hyaline, ovoid-ellipsoid, 1-septate or rarely 2-septate, $10-13 \times 3-4 \mu$.

The algal host is *Trentepohlia*.

On trees near Athens, Illinois, collected by J. Wolf (type), Fink Herb. No. 12,443. This specimen bears a name by Tuckerman but apparently no description was written by him.

Similar to *A. diffusa* Nyl., but differing in the more persistent thallus and also in the spores which are only 1- or 2-septate.

Opegraphoidea Fink, gen. nov.

A *Opegrapha* Humb. thallo parasitico et inconspicuo, in hospitis thallo immerso differens.

17. *Opegraphoidea staurothelicola* Fink, sp. nov.

Thallus parasiticus et inconspicuus, in hospitis thallo immersus; apothecia brevia et angustissima, $1.5-2.5 \times 0.08-0.1$ mm., partim immersa demum emergentia, dispersa et recta vel frequentia et varia difformia, disco clauso et indicato linea dejecta, obscura et nigra, vel rare aperto et nigro, concavo vel

plano, excipulo nigro; hypothecium crassum et obscure fuscum; hymenium pallide luteo-fuscum; paraphyses decolores, graciles, ramosae et intricatae; asci late clavati, membrana ad apicem modice incrassata cincti; sporae demum 8, decolores vel demum fuscuscentes, ellipsoideae vel uno extremo acuto, 3-septatae, loculis cylindricis, $13-15 \times 4.5-5 \mu$.

Thallus immersed in that of the lichen host and therefore invisible; apothecia short and very narrow, $1.5-2.5 \times 0.08-0.1$ mm., partly immersed to superficial, scattered and straight to clustered and variously irregular, the disk closed and indicated by an obscure, depressed black line, to rarely open, black, concave to flat, the exciple black; hypothecium thick and dark brown; hymenium pale yellowish-brown; paraphyses hyaline, slender, branched and interwoven; asci broadly clavate, the apical wall moderately thickened; spores reaching 8, hyaline to finally brownish, ellipsoid with one end often more pointed, 3-septate, the cells cylindrical, $13-15 \times 4.5-5 \mu$.

The algal host is *Trentepohlia*.

On *Staurothele umbrina* (Wahl.) Hellb. near Aberdeen, Brown County, Ohio, collected by W. A. Kellerman, November 14, 1900 (type).

A genus similar to *Opegrapha* Humb. but separated because the host is another lichen as in the case of *Thelidiella*, *Buelliella*, and others.

18. *Graphis atrorubens* Tuck. sp. nov. in herb.

Thallus mediocriter crassus, levis vel leviter confragosus et rimosus, viridescente glaucus; apothecia sat longa et angusta, $1-4 \times 0.2-0.4$ mm., partim immersa vel emergentia, plerumque curvula vel flexuosa rare ramosa, disco clauso vel aperto et rubicundo-nigro, excipulo rubicundo-fusco; sporae 8, decolores aut fuscuscentes, oblongo-ellipsoideae, 5-7-septatae, $18-28 \times 5-7 \mu$.

Thallus moderately thick, smooth to somewhat rough and chinky, greenish-gray; apothecia moderately long and narrow, $1-4 \times 0.2-0.4$ mm., partly immersed to subsuperficial, usually curved to flexuous, seldom branched, the disk closed to open, reddish-black, the proper exciple and the hypothecium reddish-brown, the exciple covered laterally by a finally disappearing thalloid one; paraphyses strong, semidistinct; asci clavate; spores 8, hyaline or brownish when old, oblong-ellipsoid, 5-7-septate, $18-28 \times 5-7 \mu$.

The algal host is *Trentepohlia*.

On trees in Georgia, collected by Ravenel in 1881 (type), Fink Herb. No. 13,746, and in Florida, collected by Miss Wilson, Fink Herb. No. 10,936. The type specimen bears the name by Tucker-

man and is a portion of a specimen from his herbarium. Apparently it was not described by him.

Similar to *Graphis scripta* (L.) Ach. and its subspecies, but differing in the somewhat thicker thallus, and the apothecia which here are commonly shorter and rarely show any branching.

19. *Phaeographina explicans* Fink, sp. nov.

Thallus tenuis, levis, virido-flavus vel olivaceus; apothecia mediocriter longa et lata, $1-3 \times 0.2-0.4$ mm., partim immersa vel adnata, recta vel ple-rumque curva aut flexuosa, rare ramosa, interdum radiate aggregata, disco aperto et plano, nigrescente fusco vel obscure canente pruinoso, excipulo fusco; sporae 8, fuscae, oblongo-ellipsoideae, 3-7-transverse septatae et 1-longitudinale septatae, $21-35 \times 8-12 \mu$.

Thallus thin, smooth, greenish-yellow to olive-green; apothecia moderately long and wide, $1-3 \times 0.3-0.4$ mm. partly immersed to adnate, straight to much more commonly curved or flexuous, rarely branched, but more often clustered, sometimes radiately so, the disk open and flat, blackish brown or obscurely grayish-pruinose, the proper exciple dark brown; hypothecium brown; hymenium hyaline to brownish; paraphyses hyaline, coherent and indistinct; asci clavate; spores 8, brown, oblong-ellipsoid, 3-7-septate transversely and 1-septate longitudinally, $21-35 \times 8-12 \mu$.

The algal host is *Trentepohlia*.

On trees near Montgomery, Alabama, collected by Dr. R. P. Burke in 1916 (type), Fink Herb. No. 14,135, and near Boloxi, Mississippi, collected by S. M. Tracy in 1897, Tracy Coll. No. 4,033. The type specimen was labelled *Graphis dendritica explicans* Tuck. but apparently no description was written by Tuckerman.

Externally much like the species of *Opegrapha*. The apothecia are not so long as in our other species of *Phaeographina*. Somewhat similar to *P. columbiana* (Tuck.) Zahlbr. in the smaller spore sizes, but differing in the more deeply colored thallus.

20. *Chiodecton subochroleucum* Fink, sp. nov.

Thallus tenuis, flavido-albus, levis vel confragosus corruendo granulato; apothecia parva, 0.4-1 mm. lata, dispersa aut frequentia, adnata, rotundata vel difformia, disco plano, rare nigro, sed saepe albido-pruinoso, excipulo rare flexuoso mediocriter evoluto; sporae 8, decolores, 3-septatae, ellipsoideae vel ellipsoideo-acutae, $19-27 \times 5-6.5 \mu$.

Thallus thin, yellowish-white, smooth to rough and granulose crumbling; apothecia small, 0.4-1 mm. across, scattered or clus-

tered, adnate, round to irregular, the disk flat, rarely black, but much more commonly whitish pruinose, the exciple rarely flexuose, only moderately developed; hypothecium blackish-brown, extending under each apothecium into a stroma of the same color; hymenium hyaline; paraphyses sometimes branched; asci becoming broadly clavate; spores 8, hyaline, 3-septate, ellipsoid to ellipsoid-pointed, $19-27 \times 5-6.5 \mu$.

The algal host is *Trentepohlia*.

On trees in southern California, collected by Pringle (type), Fink Herb. No. 10,879, and by Hasse near San Diego, Fink Herb. No. 11,892.

Similar to *C. ochroleucum* Zahlbr., but with a less well-developed exciple, and spores only 3-septate but longer and not as wide.

21. *Ocellularia floridensis* Fink, sp. nov.

Thallus tenuis vel mediocriter crassus, levis vel confragosus, rimosus, cinereo-albus; apothecia parva, 0.5–0.8 mm. lata, immersa vel emergentia, disco alte concavo, nigro aut albido-pruinoso, excipulo proprio tenue, albido, inflexo, cincto alio thalli crassiore et difformo; sporae 8, decolores, oblongo-cylindricae, leviter flexuosae, 15–29-septatae, $118-180 \times 16-20 \mu$.

Thallus thin to moderately thick, smooth to rough, chinky, ashy-white; apothecia small, 0.5–0.8 mm. across, immersed to superficial, the disk deeply concave, black or whitish pruinose, the proper exciple thin, whitish, inflexed, surrounded by a thicker, irregular, thalloid one; hypothecium and hymenium hyaline; paraphyses unbranched, free or coherent; asci clavate or broadly clavate; spores 8, hyaline, oblong-cylindrical, slightly flexuous, 15–29-septate, $118-180 \times 16-20 \mu$.

The algal host is *Trentepohlia*.

On trees in Florida, specimen bears no collector's name or date of collection (type), Fink Herb. No. 13,094.

Similar to *O. domingensis* (Fée) Müll. Arg., but having 8 spores in each ascus. The herbarium specimen was labelled *Thelotrema lepadodes* Tuck.

22. *Pyrenopsis lecideella* Fink, sp. nov.

Thallus minutè granulatus, formans crustam tenuem et inaequalem, canentem vel nigram, plus minusve continuam; apothecia minutissima vel minuta, 0.1–0.2 mm. lata, numerosa, partim immersa vel adnata, rotundata, disco leviter concavo demum plano et convexo, nigro et excipulo thalli tenue, integro

et nigro, mox evanescente; sporae 8, decolores, oblongo-ovoideae et planae in uno latere, $7-8 \times 4-4.5 \mu$, inconditae.

Thallus minutely granulose, forming a thin, uneven, grayish to black, more or less continuous crust; apothecia very minute to minute, 0.1–0.2 mm. across, numerous, partly immersed to adnate, round, the disk slightly concave to flat and convex, black, the thalloid exciple thin, entire, black, soon disappearing; hypothecium and hymenium hyaline; paraphyses hyaline, becoming coherent and semidistinct; asci clavate, with the apical wall moderately thickened; spores 8, hyaline, oblong-ovoid and flat on one side, $7-8 \times 4-4.5 \mu$, irregularly arranged.

The algal host is *Gloeocapsa*, in clusters surrounded by a pale brown sheath, much entwined and penetrated by the lichen hyphae.

On flat limestone pebble on high dry hill near Oxford, Ohio, collected by M. L. Lohman, May 21, 1927 (type).

The thallus is thinner than that of most of the species of *Pyrenopsis* from the United States. Similar to *P. fuscoatra* Fink in the thin irregular thallus, but separated by the open lecidea-like apothecia and the smaller spores.

23. *Psorotichia Hassei* Fink, sp. nov.

Thallus formatus crusta tenue, difformia, minute granulosa vel aliquantam coralloidea, olivaceo-fusca vel nigrante; apothecia minuta vel parva, 0.15–0.6 mm. lata, adnata, disco concavo vel leviter convexo, rubicundo-fusco et excipulo proprio tenue et saepe indistincto; sporae 8, decolores, non septatae, oblongae vel ovoideo-ellipsoideae, $16-24 \times 9-12 \mu$, inconditae.

Thallus composed of a thin, irregular, minutely granulose to somewhat coralloid, olive-brown to blackish crust; apothecia minute to small, 0.15–0.6 mm. across, adnate, numerous, the disk concave to slightly convex, reddish-brown, the proper exciple thin and often indistinct; hypothecium hyaline or tinged with yellowish-brown; hymenium hyaline; paraphyses unbranched, more or less coherent; asci cylindrico-clavate; spores 8, hyaline, non-septate, oblong to ovoid-ellipsoid, $16-24 \times 9-12 \mu$, irregularly arranged.

The algal host is an irregularly-shaped blue-green alga; apparently *Xanthocapsa*.

On soft disintegrating sandstone among moss, at 1650 meters in the San Jacinto Mountains, California, collected by H. E. Hasse (type), Fink Herb. No. 13,022.

The plant was reported by Hasse as *P. arnoldiana* Hepp. Zahlbruckner places this species under *Lemmopsis* Zahlbr. Our specimen is excluded from *Lemmopsis* as there is no plectenchymatous cortex. Similar to *P. Schaereri* (Mass.) Arn., but differing in the slightly thinner thallus, the smaller apothecia with a reddish brown instead of a black disk and the slightly smaller spores.

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DR. THAXTER'S METAL GUARD FOR MICROSCOPE SLIDES

WM. H. WESTON, JR.

(WITH TEXT FIGURES)

In consulting herbaria made up of specimens whose study requires microscopic examination of minute structural details, many have become convinced that it would be an ideal arrangement to have permanent mounts of such material available on the sheet with the herbarium specimen itself. If this were done, the often scanty material of irreplaceable type specimens would not be depleted by making temporary mounts for each examination, and the difficulty of consulting a card catalogue or lists to locate the slides stored in slide boxes far removed from the specimen would be avoided. Yet the problem of protecting such slides so that they will not be injured when kept with the packet of material on the herbarium sheet is a difficult one, for the material mounted on such slides in many instances does not lend itself to permanent mounting in balsam, Venetian turpentine, or gum damar, and hence must be mounted in pure glycerine¹ or lactophenol,^{2,3,4} sealed with King's cement,¹ balsam,⁵ or other sealing materials. This problem, however, was solved by Dr. Thaxter with his characteristic ingenuity by devising a metal guard which, when slipped over the permanent slide, protected it so successfully that even sealed mounts thus guarded could without injury be kept in a herbarium packet affixed to the same sheet as the specimen itself.

Realizing that this ingenious and useful slide guard would prove of great interest and value to other mycologists, the writer, with Dr. Thaxter's permission, described and demon-

¹ Bullard, C. Trans. Am. Microscopical Soc. Apr. 1921.

² Davis, W. H. Science. Dec. 10, 1929.

³ Linder, D. H. Science. Nov. 1, 1929.

⁴ Weston, W. H., Jr. Science. Nov. 8, 1929.

⁵ Diehl, W. W. Science. Mar. 8, 1929.

strated this device to the Mycological Section of the Botanical Society of America at the Cleveland meetings in 1930. Because many urged that some account of this device should be made available not only to mycologists but also to botanists in general, the writer tried to induce Dr. Thaxter to publish such a description, but he was too absorbed in work on the fifth volume on the Laboulbeniales to do so. As this slide guard is a typical example of the ingenious devices which Dr. Thaxter worked out from time to time in connection with his mycological investigations, and as it is a valuable and useful contrivance in itself, a brief description of it is presented here in the hope that it thus may have a two-fold interest to those in mycology and other branches of botany.

This slide protector consists essentially of a thin metal guard (FIG. 1) which slips over the slide (FIG. 2) protecting the cover-

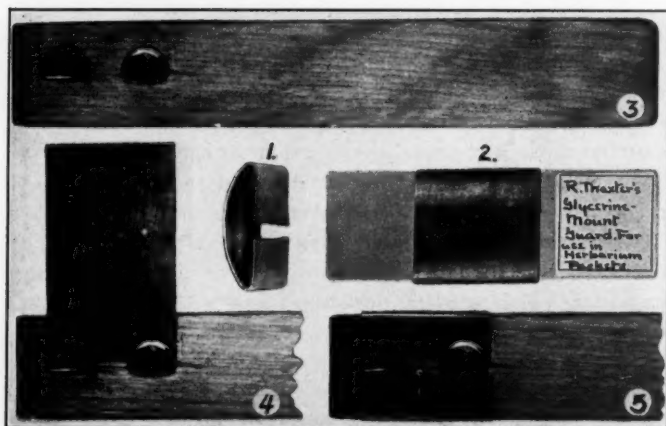


FIG. 1-5. Dr. Thaxter's metal guard for microscope slides.

glass of the mount itself with an arch of thin but springy metal and gripping the edge and lower surface of the slide securely with its two flange-like ends. For constructing these guards, sheet zinc or brass about ten one-thousandths of an inch thick is used, either metal meeting the requirements of being thin, light, easily worked, and sufficiently springy to enable the completed guard to grip the slide and to protect the coverglass of the mount

from any ordinary pressure or impact. The metal sheeting is first cut into strips 2" long and of a width from $1\frac{1}{8}$ " to 2", depending on whether a slide with one, two, or more mounts is to be protected. These metal strips are then easily and rapidly bent by hand into the proper shape over a hard wood form. In Dr. Thaxter's original model, which is illustrated here (FIG. 3), the form is of smooth, hard wood about 6" long, $15/16$ " wide, flat on the lower side, and slightly convex on the opposite face as it gradually arches to a thickness of about $3/16$ ". One end of this form, for a length of a little over 2", is very accurately shaped and slightly tapered so that the metal when bent can easily be slipped off. Two strong thumb tacks, with half of their flat metal heads cut off, are set, slightly projecting, just to one side of the middle of the flat under surface, their cut edges lying along the median line. The remaining 4" serves as a handle by which the form is held when the metal strip is being bent.

In making the guards, one end of the metal strip is fitted under the heads of the thumb tacks as in figure 4, and the strip is then bent around the form until the other end meets the thumb tacks as in figure 5.

With such a form the metal strips may easily and rapidly be shaped, and in a few minutes a supply may be produced to be kept on hand ready for use. As there is some variation in the thickness, and even in the width, of standard size microscope slides, and considerable variation in the height and area of the sealed coverglasses of finished mounts, a slight re-forming of the metal clip is necessary in adjusting the guard to the individual slide to be protected. With little difficulty, however, the metal guard may be re-formed with the fingers until it holds the slide firmly gripped with its flanges and adequately protects the mount with its arched center.

To meet individual needs, protectors of various widths may be made on the same form, and metal strips of greater or less thickness or springiness may be used. The original form used by Dr. Thaxter was made of wood and this has proved wholly satisfactory, but it would, of course, be possible to make a similar form of easily worked metal with some centering and holding device other than the thumb tacks to facilitate gripping and bending the

metal strips in the proper position. It would be easy also to devise stamping machinery which would rapidly turn out such guards in quantity, but such machinery would be expensive, and as the guards can be easily and quickly made by hand it is doubtful if the demand would justify any laboratory supply company in going to this expense.

This metal guard, as originally devised by Dr. Thaxter and made by hand on a simple wooden form, has proved entirely satisfactory and large numbers of slides protected by these metal clamps have been inserted in paper packets affixed to sheets of fungus specimens in the Farlow Herbarium where, after over two years of the treatment to which such sheets are subjected, the slides are still in perfect condition.

LABORATORIES OF CRYPTOGAMIC BOTANY,
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SOME NEW SPECIES OF HYPOXYLON

J. H. MILLER

(WITH PLATES 39 AND 40 AND 1 TEXT FIGURE)

The descriptions of the following new species of *Hypoxylon* are based on specimens sent the writer by Dr. Roland Thaxter and Prof. A. S. Muller, and others of his own collecting.

The forms which are given varietal names do not differ from the established species in sufficient characters to warrant specific rank. In most cases they are distinct only in ascospore dimensions. This latter character varies considerably with material of different ages, but there is a fairly definite maximum limit. For example, *Hypoxylon serpens* Pers. ex Fries has ascospores which vary in length from 10 to 15 μ . This species was described from Europe and all material examined there falls within these limits. In America, however, the European form is very common, but occasionally one finds what is apparently the same thing except for the much larger ascospores; that is, between 15 and 20 μ , in length. These variants may be mutants or hybrids, but in view of the present lack of knowledge of inheritance in the fungi, it seems best to give them varietal rank.

1. *Hypoxylon aeruginosum* sp. nov.

Type: No. 884 Harvard Cryptogamic Herbarium. Cotype no. 5950 Herbarium J. H. Miller.

PLATE 39, FIGS. 1-2, TEXT FIG. 1, A

Stroma late effusum, suborbiculare, 1-2 cm. longum, $\frac{1}{2}$ -1 cm. latum, $\frac{1}{2}$ -2 mm. crassum, applanatum vel irregulariter pulvinatum; ectostroma villo furfuraceo, aeruginoso; entostroma lignosum, atro-fuscum vel nigrum; peritheciis subprominulis, parvis, globosis, vel mutua pressione deformatis, verticibus vix emergentibus, ostioliis umbilicatis, 300-500 μ in diam.; ascis cylindricis (pars spor.) 40-50 μ , pedicello 40-60 μ longo; ascosporis oblique monostichis, plano-convexis, brunneis, 7.2-10 \times 3.5-4.5 μ .

This fungus occurs on bark and decorticated wood, becoming more pulvinate and thicker on the former. No conidia have been found.

Collected by Dr. D. H. Linder, Feb. 2, 1924, Pl. Voyheid, British, Guiana.

This species is readily distinguished by its peculiar copper-blue color, which must be exceedingly rare in the genus. With

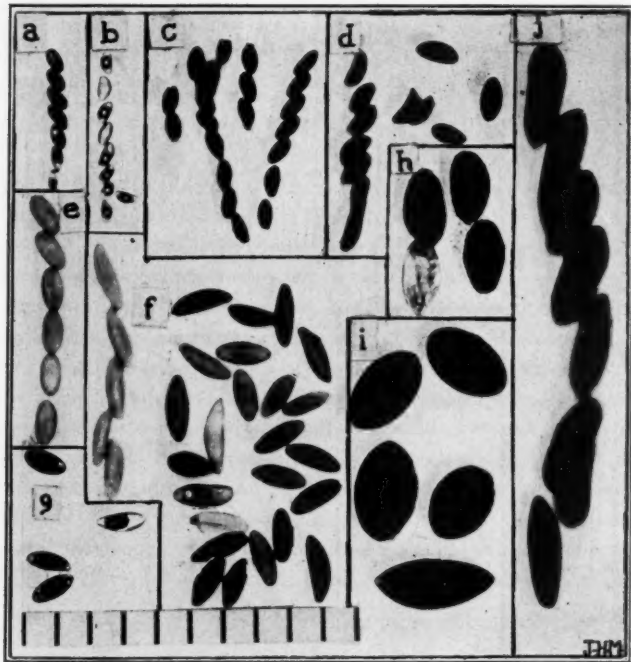


FIG. 1. Photomicrographs of ascospores of species and varieties of *Hypoxylon* listed below. All were photographed with the same camera and microscope combinations: a, *Hypoxylon aeruginosum*; b, *H. erythrostroma*; c, *H. croceum*; d, *H. Mulleri*; e, *H. cinereo-lilacinum*; f, *H. serpens* var. *macrospora*; g, *H. serpens*; h, *H. regale*; i, *H. regale* var. *macrospora*; j, *H. vogesiacum* var. *macrospora*.

its colored ectostroma, non-carbonous entostroma, non-extruded ostiola, it falls in the group with *H. rubiginosum* Pers. ex Fries, *H. haematostroma* Mont., *H. papillatum* Ellis & Ev., and others. The young stroma of *H. papillatum* more nearly approaches it in color, but it is more of a green than a blue. The colored ecto-

stroma wears off in old specimens leaving a black stroma which would be difficult to identify.

The name *aeruginosum* was suggested by Dr. Thaxter.

2. *Hypoxylon croceum* sp. nov.

Type: No. 6610 Herbarium J. H. Miller. Cotype deposited at Harvard Herbarium and at the Kew Herbarium.

PLATE 39, FIGS. 3-4, TEXT FIG. 1, C

Stroma elongatum effusum vel pulvinatum, discretum, 1-6 mm. diam. vel undulato-confluens, 1-2 mm. crassum, primo applanatum, maturitate efformatum ex peritheciis liberis verticibus, tuberculosum, laete crocium maturitate fulvo-brunneum; entostroma coriaceum vel lignosum; peritheciis parvis, subconfertis, ovato-globosis, vertice prominentibus, ostiolo papillato, nigri punctiformi, deinde pertuso, ascis longis attenuatis (pars spor.) 45-55 μ , pedicellis usque 40-50 μ longis; ascosporis plano-convexis, 1-2 guttis, brunneis deinde opacis, 8-11 \times 4-5 μ . Conidia minuta, hyalina, ovata, vel oblonga, 4-5 μ diam., initio ectostroma vestientia.

On *Liriodendron tulipifera* L. covering the lower side of an old log. Mountain City, Ga., Aug. 7, 1928. Also found at Highlands, N. C., Aug. 1932.

The fresh, initial stage, of this species is bright yellow resembling the plasmodial stage of a Myxomycete, but when dried it assumes a dull yellow-brown color. There are two other species in shades of yellow, and both have effused stromata with very prominent perithecia. One however, *H. Morgani* Ellis & Ev., is readily distinguishable by having ascospores 35-38 μ in length, and the other, *H. chrysoconium* Berk. & Br., has more of an orange colored ectostroma than yellow, with perithecia more widely separated in the stroma.

3. *Hypoxylon erythrostroma* sp. nov.

Type: No. 2 Herbarium of R. Thaxter, Florida Collection.

PLATE 39, FIGS. 5-6, TEXT FIG. 1, B

Stroma late effusum, leve et applanatum, in ligno decorticato, vel undulatum, crasso margine rotundato, in ligno corticato, 1-2 mm. altum; ectostroma laete griseo-brunneum dein cinereo-nigrescens cum margine cinereo; intus inter perithecia sanguineum; entostroma carneo-coriaceum vel lignosum; peritheciis monostichis in margine stromatis, $\frac{1}{2}$ -1 mm. diam., globoso-angulatis vertice rotundato haud emergente, ostiola umbilicata, minutissime pertusa; ascis cylindricis, stipitatis (pars. spor.), 40-50 μ longo; ascosporis brunneis, oblongo-ellipticis, in aetate plano-convexis, 6.5-9 \times 3-4.5 μ .

Collected by R. Thaxter, no. 2 and no. 7, Daytona, Fla. and no. 16 Cocoanut Grove, Fla. Host deciduous tree.

This species approaches *H. rutilum* Tul. and *H. jecorinum* Berk & Br. The ascospore measurements as well as the blood-red particles between the perithecia are common to the three. It differs from the former in lacking the definitely exerted perithecial vertices and from the latter in the color of the ectostroma. The color in *H. jecorinum* varies from bright red to yellowish-red, while in *H. erythrostroma* the color is brownish-gray to a very pale gray.

4. **Hypoxylon Mulleri** sp. nov.

Type: No. 6618, Herbarium J. H. Miller. Cotype deposited in Harvard Cryptogamic Herbarium and at Kew Herbarium.

PLATE 39, FIGS. 7-8, TEXT FIG. 1, D

Stroma convexo-pulvinatum, 1-8 cm. longum, 1-3 cm. latum, .5-1 cm crassum; ectostroma primo pulverulento-brunneum, in aetate nigrum, carbonaceum; entostroma lignosum, subpulveraceum, fibrosum, spurie zonatum; peritheciis periphericis, angulatis, elongatis, stipatis, vertice subapplanato haud emergente, ostiolis umbilicatis, opacis, minutis; ascosporis brunneis aetate opacis, ellipticis, rotundatis vel plano-convexis, $11.2-15 \times 5.6-6.6 \mu$. In ligno.

Collected A. S. Muller, Las Vegas, P. R., June 19, 1929.

This species resembles *H. placentiforme* in form, but differs in the brown rather than purplish-red color of the latter and in the rough surface due to partially projecting perithecia. Large forms of *H. truncatum* (Schw. ex Fries) Mill. closely approach this one, but are distinct in the possession of papillate ostiola and smaller ascospores.

There are two or three faintly distinct zones in the entostroma, which would make this a transitional form between *Hypoxylon* and *Daldinia*. Lloyd (2: 1181) creates the genus *Hypodiscus* for such forms, but there are too many genera now in the Xylariaceae separated only on stromal form. This character varies so constantly with conditions of growth, that when taken alone, is not sufficient for generic separations. The genus *Hypodiscus* should therefore be discarded.

5. **Hypoxylon cinereo-lilacinum** sp. nov.

Type: No. 1180, Ellis & Ev. N. Am. Fungi, Cornell Department of Plant Pathology Herbarium, sub *H. atropurpureum*.

PLATE 40, FIGS. 1-2, TEXT FIG. 1, E

Stroma late effusum, indeterminatum, tenuissimum, $3-4 \times 1-2$ cm., .5-1 mm. crassum, leve vel cum ligno corticato undulatum, coriaceum, haud carbonaceum; ectostroma primo laete griseum, paene album, in aetate cinereo-lilacinum, margine albo, atris ostioliis distinctum et in senectute paene nigrum; entostroma nigrum; peritheciis globosis vel oblongis, monostichiis valde stipatis, compressis, ex ectostromate emergentibus ostioliis brevibus, papillatis, truncatis; ascis cylindricis, $55-75 \mu$ (pars spor.) et $40-50 \mu$ pedicello; ascosporis plano-convexis vel cylindricis, brunneis, $11-15 \times 5-6.5 \mu$, saepissime $12 \times 5 \mu$. In ligno.

The light purple-gray color, very thin plane stroma with white sterile margin, and no perithecial elevations, distinguish this species.

It occurs chiefly in the middle western United States, but Ellis cites it from Canada and from New York. Most of the specimens seen by the writer are from Iowa, Kansas and Tennessee.

Ellis determined this as *H. atropurpureum* Fries, but he was mistaken as that name was applied by Fries to the effused form of *H. multiforme* Fries.

The nearest related species is *H. fuscillum* (Rehm) Mill., based on exsicc. no. 481, W. H. Long from Texas. The writer finds the ascospores in that specimen to be $12-17 \times 6-8.5 \mu$, consistently larger than in the above species. Also Rehm's species is distinguished by its carbonous stroma. The color of the ectostroma is very similar in both species.

Superficially this species resembles *H. albosictum* (Morg.) Mill., but differs in possessing black papillate ostiola instead of the light colored umbilicate ones of the latter.

Specimens examined: Fungi Columb. no. 241, sub *H. atropurpureum* Fries, Cornell University; Holway no. 176, Iowa University Herbarium no. 6, 1896; Ellis & Ev. N. Am. Fungi, no. 1180, collected Holway, Decorah, Ia.; R. P. White nos. 1 and 5, Manhattan, Kans., Dec. and Feb. 1922; Thaxter nos. 71-76, Burbank, Tenn.

6. *HYPOXYLON VOGESIIACUM* Pers. ex Sacc. var. ***macrosporum*** var. nov.

Type: No. 7067, Herbarium J. H. Miller. Cotype in University of Michigan Herbarium.

PLATE 40, FIGS. 7-8, TEXT FIG. 1, J

Differt ab *H. vogesiaco* majoribus ascosporis.

The ascospores in this variety differ from those of the species in possession of larger dimensions, $26.2-37.8 \times 7-12 \mu$. Aside from the larger ascospores the other characters are similar to those of the species.

Collected by C. H. Kauffman and C. L. Wehmeyer in Wyoming.

Note on the species *Hypoxylon vogesiacum*: This form has not been well understood in the United States nor in Europe. The type no. 765 Moug. et Nestl. Stirp. Vog.-rhen., at the University of Leiden, is an old specimen, and has ascospores measuring $14-20 \times 6-8 \mu$. Smaller spores than the maximum are to be found in collections of younger stromata. The stroma is widely effused and fairly smooth, without marked perithecial elevations. This character, however, varies in European specimens to ones with protruding perithecia as in exsicc. no. 238 Myc. Carp. by Petrak (sub *H. aeneum* Nits.). The color ranges from a reddish-purple to brownish-purple to almost black in age. Nitschke (4, 35) describes the spores of *H. fuscum* Pers. ex Fries as $12-20 \mu$, in length, which would include the species *vogesiacum*, however these two species are distinct in spore measurements and in color.

The red series of *Hypoxylon* presents a difficult problem. In Europe there are *rubiginosum*, with ascospores $9-11 \times 4-6 \mu$, and *vogesiacum* with ones $14-20 \times 6-8 \mu$, with no transitional forms. *H. fuscum* does not lie in this series because it does not usually present the shades of red found here. The tropical forms begin with one with smaller ascospores than those of *rubiginosum* and terminate with ones up to 37.8μ , in length. Many specific names have been applied to members of this group, but Theissen (6: 151) concludes that the series constitutes a single species. This would appear logical except that in other parts of the world there are ones that are constant in the spore dimensions and with no intervening forms to bridge the gaps, as one finds in the tropics. Therefore, if we split this natural group into species we must think of them only as local entities.

The tropical form nearest *vogesiacum*, according to European specimens, would be *H. haematostroma* Mont. Spores of the

cotype at Kew are $14-18 \times 7-9 \mu$. Cooke (1: 124) describes them as $10-12 \times 3.5 \mu$, and the Montagne specimen at Kew is the one he had access to. He must have measured spores of a specimen of *rubiginosum*, which is on the same sheet. This error was probably copied by Theissen (l. c. 149) as he uses $10-13 \times 4.5-5.5 \mu$. The latter (l. c. 145) also used the names *H. vividum* Berk & Br. and *H. haematites* Lév. ex Cooke as distinct species as does Rick (5: 27) more recently. Types of the latter two are in Kew and are identical with *haematostroma* and the latter name has priority.

Under *H. haematites* Theissen (l. c. 146) describes a variety *microspora* (sp. $15.5-21 \times 7.5-11 \mu$) and a variety *macrospora* (sp. $20-27 \times 12-14 \mu$). The writer has specimens from Brazil named by Theissen *haematites* which are very similar to the European or Canadian specimens of *vogesiacum*. A dark purplish-red color is seen in both Brazilian and European specimens and the ascospores are equal. The shade of red or purple, however, in this group has practically no diagnostic value as this depends entirely on the amount of moisture present during the development of the stroma and on the amount of light and on the age.

H. vogesiacum then is world wide in distribution and belongs in the red series with ascospores $14-20 \times 6-8 \mu$, a little larger than those of *H. haematostroma*, and is found chiefly in the cold temperate regions, while the other species is chiefly confined to the tropics. Also usually in *haematostroma* there are blood-red particles between the perithecia, and this is not so evident in *vogesiacum*.

The variety described here is one of *vogesiacum* rather than of *haematites* as the latter name is a nomen nudum.

7. *HYPOXYLON SERPENS* Pers. ex Fries var. *macrosporum* var. nov.

Type: No. 7090, Herbarium J. H. Miller.

PLATE 40, FIGS. 3-4, TEXT FIG. 1, F

Differt ab *H. serpenti* majoribus ascosporis.

The ascospores in the variety are $13-22 \times 5-8 \mu$. The other characters are the same as those of the species.

The Persoon type of *serpens* has ascospores (TEXT FIG. 1, G) $11-15 \times 5-7 \mu$. The writer has found no European specimens

with the appearance of *serpens*, but with the large spores of this variety. This form of the species is common in the western United States, and has been found from Canada to Georgia in the east. Like the species it appears to have no special host plant, but occurs on dead wood of many deciduous trees. The type is from Idaho, Aug. 1922.

It differs from *H. semiimmersum* Nits. in possessing narrowly navicular ascospores instead of the broadly fusoid ones of that species. Also the stroma is usually widely effused as is typical of *serpens*, and is not composed of just a few perithecia as is *semiimmersum*.

8. *HYPOXYLON REGALE* Morg. var. **macrosporum** var. nov.

Type: No. 6867 Herbarium J. H. Miller.

PLATE 40, FIGS. 5-6, TEXT FIG. 1, I

Differt ab *H. regali* majoribus ascosporis.

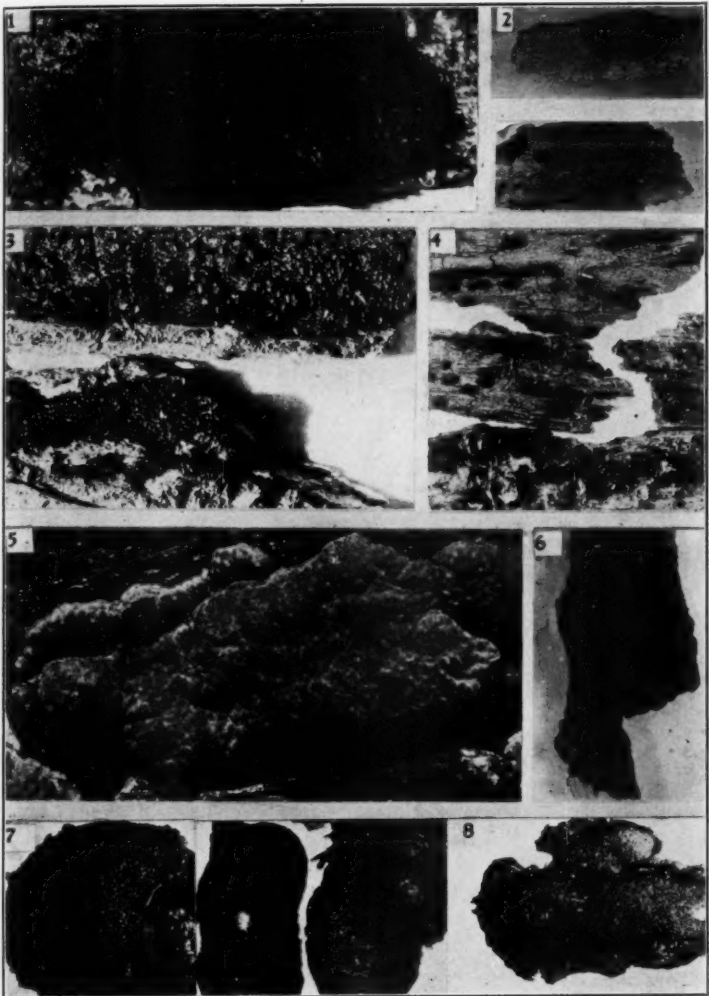
This variety differs in possession of larger ascospores, 25-40 \times 14-20 μ .

Collected on dead log of *Quercus montana*, Whitehall, Ga. Nov. 7, 1930.

The stroma, as with the species, is very small, consisting of a few perithecia connected by a covering of black ectostroma. The perithecia are seated directly in the wood, and there is very little entostroma. It is found chiefly on decorticated oak wood, and has the same general appearance as the European species *H. semiimmersum* and *H. udum* Pers. ex Berk.

The Morgan type of the species has ascospores 20-27 \times 10-14 μ (TEXT FIG. 1, H), usually 25 \times 12 μ , with a tendency to become fusoid as are those of *semiimmersum*. The latter species and *udum* apparently occur only in Europe, while *H. regale* and the variety occur in the United States. In spore characters *H. regale* is a connecting link between the two European species, and the variety of *regale* possesses ascospores much larger than *udum*.

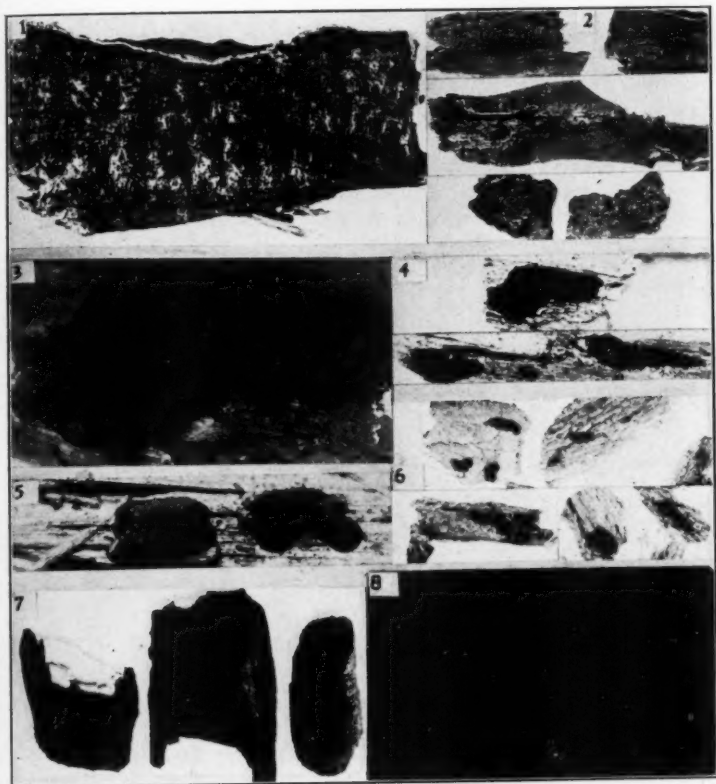
UNIVERSITY OF GEORGIA,
ATHENS, GEORGIA



HYPOXYLON

M





HYPOXYLON

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EXPLANATION OF PLATES

PLATE 39

Fig. 1. *Hypoxylon aeruginosum* $\times 15$, type, collected by D. F. Linder, British Guiana; 2. The above natural size; 3. *Hypoxylon croceum* $\times 5$, type, from Mountain City, Ga.; 4. The above nat. size, showing young undifferentiated stromata in upper part of cut and mature perithecia below; 5. *Hypoxylon erythrostroma* $\times 15$, type, from Daytona, Fla.; 6. The above nat. size; 7. *Hypoxylon Mulleri* $\times 4$, type, from Porto Rico; 8. The above nat. size.

PLATE 40

Fig. 1. *Hypoxylon cinereo-lilacinum* $\times 8$, type, Ellis & Ev. *N. Am. Fungi*, no. 1180; 2. The above nat. size; 3. *Hypoxylon serpens* var. *macrosporum* $\times 10$, type from Idaho, collected by L. E. Wehmeyer, Aug. 21, 1922; 4. The above nat. size; 5. *Hypoxylon regale* var. *macrosporum* $\times 20$, type, from Whitehall, Ga.; 6. The above nat. size; 7. *Hypoxylon vogesiacum* var. *macrosporum* $\times 2$, type, from Wyoming, collected by C. H. Kauffman and L. E. Wehmeyer; 8. The above $\times 10$.

NOTES AND BRIEF ARTICLES

THE MYCOLOGICAL FORAY

(WITH 1 TEXT FIGURE)

The first summer meeting of the Mycological Society of America, in the form of a foray, will be held at Highlands, North Carolina, August 17 to 19, 1933. The Board of Trustees, the Director, and Members of the Highlands Museum and Biological Laboratory, located at Highlands, extend a cordial invitation to

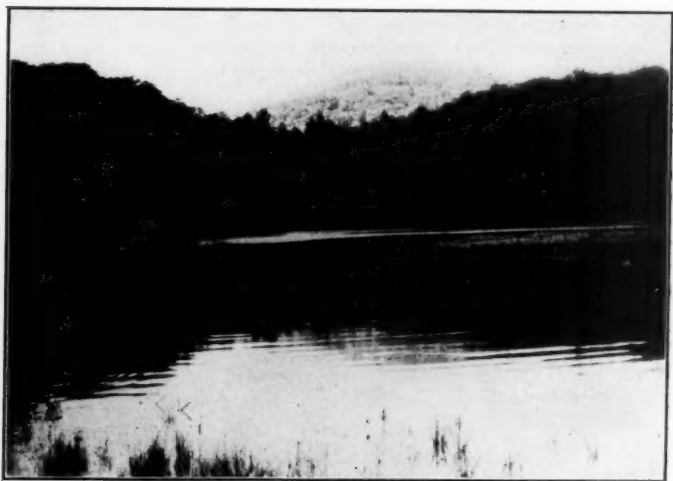


FIG. 1. Ravanel Lake, with Mt. Satulah in background. The Highlands Laboratory is situated on the banks of the Lake.

all mycologists to avail themselves of the favorable opportunity to collect in the Southern Appalachian Mountains.

Highlands is located in Macon County, southwestern North Carolina, near the Georgia and South Carolina boundary lines. It is accessible by good roads through Asheville, Knoxville or Atlanta. Satisfactory hotel accommodations at reasonable rates may be had in the village. Since Highlands is situated on a

plateau at an elevation of about 4000 feet, pleasant days and cool nights may be guaranteed.

As is well known, rainfall is heavy in the Southern Appalachian Mountains. At Highlands, the average annual precipitation is about 90 inches. Moreover, the vegetation there is heavy and varied. Within the confines of the plateau, one finds dense forests (some virgin), open woods, gorges, grassy flats, and a few artificial lakes, all within short distances of the laboratory.

The laboratory itself is new and well-built. It is equipped with running water and electricity. A moderate supply of blotter-driers and plant press equipment, an electrically heated drier, and 3 or 4 microscopes are available. Other items, such as a vasculum, incidental to field collecting should be brought by those attending the foray.

Visiting mycologists will be given opportunity to visit the Great Smoky Mountains National Park. The Park may be reached by good road within two hours from Highlands. In normal seasons, fungi are likewise abundant in the Great Smokies. Those who may care to remain over night near the Park area will find excellent accommodations at the Mountain View Hotel, Gatlinburg, Tennessee.

W. C. COKER, E. E. REINKE, AND L. R. HESLER,
Committee on Arrangements.



